OpenShift Container Platform 4.3

Logging

Configuring cluster logging in OpenShift Container Platform
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Configuring cluster logging in OpenShift Container Platform
Abstract

This document provides instructions for installing, configuring, and using cluster logging, which aggregates logs for a range of OpenShift Container Platform services.
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CHAPTER 1. UNDERSTANDING CLUSTER LOGGING AND OPENSHIFT CONTAINER PLATFORM

As an OpenShift Container Platform cluster administrator, you can deploy cluster logging to aggregate all the logs from your OpenShift Container Platform cluster, such as node system logs, application container logs, and so forth.

1.1. CLUSTER LOGGING

OpenShift Container Platform cluster administrators can deploy cluster logging using a few CLI commands and the OpenShift Container Platform web console to install the Elasticsearch Operator and Cluster Logging Operator. When the operators are installed, create a Cluster Logging Custom Resource (CR) to schedule cluster logging pods and other resources necessary to support cluster logging. The operators are responsible for deploying, upgrading, and maintaining cluster logging.

You can configure cluster logging by modifying the Cluster Logging Custom Resource (CR), named instance. The CR defines a complete cluster logging deployment that includes all the components of the logging stack to collect, store and visualize logs. The Cluster Logging Operator watches the ClusterLogging Custom Resource and adjusts the logging deployment accordingly.

Administrators and application developers can view the logs of the projects for which they have view access.

1.1.1. Cluster logging components

The cluster logging components are based upon Elasticsearch, Fluentd, and Kibana (EFK). The collector, Fluentd, is deployed to each node in the OpenShift Container Platform cluster. It collects all node and container logs and writes them to Elasticsearch (ES). Kibana is the centralized, web UI where users and administrators can create rich visualizations and dashboards with the aggregated data.

There are currently 5 different types of cluster logging components:

- logStore - This is where the logs will be stored. The current implementation is Elasticsearch.
- collection - This is the component that collects logs from the node, formats them, and stores them in the logStore. The current implementation is Fluentd.
- visualization - This is the UI component used to view logs, graphs, charts, and so forth. The current implementation is Kibana.
- curation - This is the component that trims logs by age. The current implementation is Curator.
- event routing - This is the component forwards OpenShift Container Platform events to cluster logging. The current implementation is Event Router.

In this document, we may refer to logStore or Elasticsearch, visualization or Kibana, curation or Curator, collection or Fluentd, interchangeably, except where noted.

1.1.2. About the logstore

OpenShift Container Platform uses Elasticsearch (ES) to organize the log data from Fluentd into datastores, or indices.

Elasticsearch subdivides each index into multiple pieces called shards, which it spreads across a set of Elasticsearch nodes in an Elasticsearch cluster. You can configure Elasticsearch to make copies of the
shards, called *replicas*. Elasticsearch also spreads these replicas across the Elasticsearch nodes. The *ClusterLogging* Custom Resource allows you to specify the replication policy in the Custom Resource Definition (CRD) to provide data redundancy and resilience to failure.

**NOTE**

The number of primary shards for the index templates is equal to the number of Elasticsearch data nodes.

The Cluster Logging Operator and companion Elasticsearch Operator ensure that each Elasticsearch node is deployed using a unique Deployment that includes its own storage volume. You can use a Cluster Logging Custom Resource (CR) to increase the number of Elasticsearch nodes. Refer to [Elastic's documentation](https://www.elastic.co/guide/en/elasticsearch/reference/current/custom-resources.html) for considerations involved in choosing storage and network location as directed below.

**NOTE**

A highly-available Elasticsearch environment requires at least three Elasticsearch nodes, each on a different host.

Role-based access control (RBAC) applied on the Elasticsearch indices enables the controlled access of the logs to the developers. Access to the indexes with the `project.{project_name}.{project_uuid}.*` format is restricted based on the permissions of the user in the specific project.

For more information, see [Elasticsearch (ES)](https://www.elastic.co/guide/en/elasticsearch/reference/current/index-management.html).

### 1.1.3. About the logging collector

OpenShift Container Platform uses Fluentd to collect data about your cluster.

The logging collector is deployed as a DaemonSet in OpenShift Container Platform that deploys pods to each OpenShift Container Platform node. *journald* is the system log source supplying log messages from the operating system, the container runtime, and OpenShift Container Platform.

The container runtimes provide minimal information to identify the source of log messages: project, pod name, and container id. This is not sufficient to uniquely identify the source of the logs. If a pod with a given name and project is deleted before the log collector begins processing its logs, information from the API server, such as labels and annotations, might not be available. There might not be a way to distinguish the log messages from a similarly named pod and project or trace the logs to their source. This limitation means log collection and normalization is considered **best effort**.

**IMPORTANT**

The available container runtimes provide minimal information to identify the source of log messages and do not guarantee unique individual log messages or that these messages can be traced to their source.

For more information, see [Fluentd](https://fluentd.org/).

### 1.1.4. About logging visualization

OpenShift Container Platform uses Kibana to display the log data collected by Fluentd and indexed by Elasticsearch.
Kibana is a browser-based console interface to query, discover, and visualize your Elasticsearch data through histograms, line graphs, pie charts, heat maps, built-in geospatial support, and other visualizations.

For more information, see Kibana.

1.1.5. About logging curation

The Elasticsearch Curator tool performs scheduled maintenance operations on a global and/or on a per-project basis. Curator performs actions based on its configuration. Only one Curator Pod is recommended per Elasticsearch cluster.

```
spec:
  curation:
    type: "curator"
    resources:
      curator:
        schedule: "30 3 * * *"
```

Specify the Curator schedule in the cron format.

For more information, see Curator.

1.1.6. About event routing

The Event Router is a pod that forwards OpenShift Container Platform events to cluster logging. You must manually deploy Event Router.

The Event Router collects events and converts them into JSON format, which takes those events and pushes them to STDOUT. Fluentd indexes the events to the .operations index.

1.1.7. About the Cluster Logging Custom Resource

To make changes to your cluster logging deployment, create and modify the Cluster Logging Custom Resource (CR). Instructions for creating or modifying a CR are provided in this documentation as appropriate.

The following is an example of a typical Custom Resource for cluster logging.

**Sample Cluster Logging CR**

```
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: openshift-logging
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 2
      resources:
```

8
memory: 2Gi
requests:
cpu: 200m
memory: 2Gi
storage:
  storageClassName: "gp2"
  size: "200G"
  redundancyPolicy: "SingleRedundancy"
visualization:
type: "kibana"
kibana:
  resources:
    limits:
      memory: 1Gi
    requests:
      cpu: 500m
      memory: 1Gi
proxy:
  resources:
    limits:
      memory: 100Mi
    requests:
      cpu: 100m
      memory: 100Mi
replicas: 2
curation:
type: "curator"
curator:
  resources:
    limits:
      memory: 200Mi
    requests:
      cpu: 200m
      memory: 200Mi
schedule: "*/10 * * * *
collection:
logs:
type: "fluentd"
fluentd:
  resources:
    limits:
      memory: 1Gi
    requests:
      cpu: 200m
      memory: 1Gi
CHAPTER 2. ABOUT DEPLOYING CLUSTER LOGGING

Before installing cluster logging into your OpenShift Container Platform cluster, review the following sections.

2.1. ABOUT DEPLOYING AND CONFIGURING CLUSTER LOGGING

OpenShift Container Platform cluster logging is designed to be used with the default configuration, which is tuned for small to medium sized OpenShift Container Platform clusters.

The installation instructions that follow include a sample Cluster Logging Custom Resource (CR), which you can use to create a cluster logging instance and configure your cluster logging deployment.

If you want to use the default cluster logging install, you can use the sample CR directly.

If you want to customize your deployment, make changes to the sample CR as needed. The following describes the configurations you can make when installing your cluster logging instance or modify after installation. See the Configuring sections for more information on working with each component, including modifications you can make outside of the Cluster Logging Custom Resource.

2.1.1. Configuring and Tuning Cluster Logging

You can configure your cluster logging environment by modifying the Cluster Logging Custom Resource deployed in the openshift-logging project.

You can modify any of the following components upon install or after install:

Memory and CPU

You can adjust both the CPU and memory limits for each component by modifying the resources block with valid memory and CPU values:

```yaml
spec:
  logStore:
    elasticsearch:
      resources:
        limits:
          cpu: 1
          memory: 16Gi
        requests:
          cpu: 1
          memory: 16Gi
      type: "elasticsearch"
    collection:
      logs:
        fluentd:
          resources:
            limits:
              cpu: 1
              memory: 16Gi
            requests:
              cpu: 1
              memory: 16Gi
            type: "fluentd"
        visualization:
          kibana:
```
Elasticsearch storage

You can configure a persistent storage class and size for the Elasticsearch cluster using the `storageClass` name and `size` parameters. The Cluster Logging Operator creates a `PersistentVolumeClaim` for each data node in the Elasticsearch cluster based on these parameters.

This example specifies each data node in the cluster will be bound to a `PersistentVolumeClaim` that requests "200G" of "gp2" storage. Each primary shard will be backed by a single replica.

**NOTE**

Omitting the `storage` block results in a deployment that includes ephemeral storage only.

Elasticsearch replication policy

You can set the policy that defines how Elasticsearch shards are replicated across data nodes in the cluster:

- **FullRedundancy**. The shards for each index are fully replicated to every data node.
- **MultipleRedundancy**. The shards for each index are spread over half of the data nodes.
- **SingleRedundancy.** A single copy of each shard. Logs are always available and recoverable as long as at least two data nodes exist.

- **ZeroRedundancy.** No copies of any shards. Logs may be unavailable (or lost) in the event a node is down or fails.

**Curator schedule**

You specify the schedule for Curator in the [cron format](https://en.wikipedia.org/wiki/Cron).

```yaml
spec:
  curation:
    type: "curator"
  resources:
    curator:
      schedule: "30 3 * * *
```

### 2.1.2. Sample modified Cluster Logging Custom Resource

The following is an example of a Cluster Logging Custom Resource modified using the options previously described.

**Sample modified Cluster Logging Custom Resource**

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: "openshift-logging"
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 2
      resources:
        limits:
          memory: 2Gi
        requests:
          cpu: 200m
          memory: 2Gi
      storage: {}
    redundancyPolicy: "SingleRedundancy"
  visualization:
    type: "kibana"
    kibana:
      resources:
        limits:
          memory: 1Gi
      requests:
        cpu: 500m
        memory: 1Gi
      replicas: 1
    curation:
      type: "curator"
```
2.2. STORAGE CONSIDERATIONS FOR CLUSTER LOGGING AND OPENSHIFT CONTAINER PLATFORM

A persistent volume is required for each Elasticsearch deployment to have one data volume per data node. On OpenShift Container Platform this is achieved using Persistent Volume Claims.

The Elasticsearch Operator names the PVCs using the Elasticsearch resource name. Refer to Persistent Elasticsearch Storage for more details.

Fluentd ships any logs from `systemd journal` and `/var/log/containers/` to Elasticsearch.

Therefore, consider how much data you need in advance and that you are aggregating application log data. Some Elasticsearch users have found that it is necessary to keep absolute storage consumption around 50% and below 70% at all times. This helps to avoid Elasticsearch becoming unresponsive during large merge operations.

By default, at 85% Elasticsearch stops allocating new data to the node, at 90% Elasticsearch attempts to relocate existing shards from that node to other nodes if possible. But if no nodes have free capacity below 85%, Elasticsearch effectively rejects creating new indices and becomes RED.

**NOTE**

These low and high watermark values are Elasticsearch defaults in the current release. You can modify these values, but you also must apply any modifications to the alerts also. The alerts are based on these defaults.

2.3. ADDITIONAL RESOURCES

For more information on installing operators, see Installing Operators from the OperatorHub.
CHAPTER 3. DEPLOYING CLUSTER LOGGING

You can install cluster logging by deploying the Elasticsearch and Cluster Logging Operators. The Elasticsearch Operator creates and manages the Elasticsearch cluster used by cluster logging. The Cluster Logging Operator creates and manages the components of the logging stack.

The process for deploying cluster logging to OpenShift Container Platform involves:

- Reviewing the installation options in About deploying cluster logging.
- Reviewing the cluster logging storage considerations.
- Installing the Elasticsearch Operator and Cluster Logging Operator.

3.1. INSTALL THE ELASTICSEARCH OPERATOR USING THE CLI

You must install the Elasticsearch Operator using the CLI following the directions below.

Prerequisites

Ensure that you have the necessary persistent storage for Elasticsearch. Note that each Elasticsearch node requires its own storage volume.

Elasticsearch is a memory-intensive application. Each Elasticsearch node needs 16G of memory for both memory requests and limits. The initial set of OpenShift Container Platform nodes might not be large enough to support the Elasticsearch cluster. You must add additional nodes to the OpenShift Container Platform cluster to run with the recommended or higher memory. Each Elasticsearch node can operate with a lower memory setting though this is not recommended for production deployments.

Procedure

To install the Elasticsearch Operator using the CLI:

1. Create a Namespace for the Elasticsearch Operator.
   a. Create a Namespace object YAML file (for example, eo-namespace.yaml) for the Elasticsearch Operator:

   ```yaml
   apiVersion: v1
   kind: Namespace
   metadata:
     name: openshift-operators-redhat
   annotations:
     openshift.io/node-selector: ""
   labels:
     openshift.io/cluster-monitoring: "true"
   ```

   You must specify the openshift-operators-redhat Namespace. To prevent possible conflicts with metrics, you should configure the Prometheus Cluster Monitoring stack to scrape metrics from the openshift-operators-redhat Namespace and not the openshift-operators Namespace. The openshift-operators Namespace might contain Community Operators, which are untrusted and could publish a metric with the same name as an OpenShift Container Platform metric, which would cause conflicts.

   You must specify this label as shown to ensure that cluster monitoring scrapes the openshift-operators-redhat Namespace.
b. Create the Namespace:

$ oc create -f <file-name>.yaml

For example:

$ oc create -f eo-namespace.yaml

2. Install the Elasticsearch Operator by creating the following objects:

a. Create an Operator Group object YAML file (for example, eo-og.yaml) for the Elasticsearch operator:

```yaml
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: openshift-operators-redhat
  namespace: openshift-operators-redhat
spec: {}
```

1 You must specify the `openshift-operators-redhat` Namespace.

b. Create an Operator Group object:

$ oc create -f <file-name>.yaml

For example:

$ oc create -f eo-og.yaml

c. Create a Subscription object YAML file (for example, eo-sub.yaml) to subscribe a Namespace to an Operator.

Example Subscription

```yaml
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: "elasticsearch-operator"
  namespace: "openshift-operators-redhat"
spec:
  channel: "4.3"
  installPlanApproval: "Automatic"
  source: "redhat-operators"
  sourceNamespace: "openshift-marketplace"
  name: "elasticsearch-operator"
```

1 You must specify the `openshift-operators-redhat` Namespace.

2 Specify 4.3 as the channel.

3 Specify `redhat-operators`. If your OpenShift Container Platform cluster is installed on a restricted network, also known as a disconnected cluster, specify the name of the
CatalogSource object created when you configured the Operator Lifecycle Manager (OLM).

d. Create the Subscription object:

```bash
$ oc create -f <file-name>.yaml
```

For example:

```bash
$ oc create -f eo-sub.yaml
```

e. Change to the `openshift-operators-redhat` project:

```bash
$ oc project openshift-operators-redhat
```

Now using project "openshift-operators-redhat"

f. Create a Role-based Access Control (RBAC) object file (for example, `eo-rbac.yaml`) to grant Prometheus permission to access the `openshift-operators-redhat` Namespace:

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: prometheus-k8s
  namespace: openshift-operators-redhat
rules:
- apiGroups:
  - ""
  resources:
  - services
  - endpoints
  - pods
  verbs:
  - get
  - list
  - watch
---
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: prometheus-k8s
  namespace: openshift-operators-redhat
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: prometheus-k8s
subjects:
- kind: ServiceAccount
  name: prometheus-k8s
  namespace: openshift-operators-redhat
```

g. Create the RBAC object:
3. Verify the Operator installation:

```bash
oc get csv --all-namespaces
```

<table>
<thead>
<tr>
<th>NAMESPACE</th>
<th>NAME</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>default</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>kube-node-lease</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>kube-public</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>kube-system</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>openshift-apiserver-operator</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>openshift-apiserver</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>openshift-authorization-operator</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>openshift-authorization</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
<tr>
<td>Elasticsearch Operator</td>
<td>Elasticsearch Operator</td>
<td>4.3.1-202002032140</td>
</tr>
</tbody>
</table>

There should be an Elasticsearch Operator in each Namespace. The version number might be different than shown.

Next step

Install the Cluster Logging Operator using the Console or the CLI using the steps in the following sections.

3.2. INSTALL THE CLUSTER LOGGING OPERATOR USING THE WEB CONSOLE

You can use the OpenShift Container Platform web console to install the Cluster Logging Operator.

NOTE

You cannot create a Project starting with `openshift-` using the web console or by using the `oc new-project` command. You must create a Namespace using a YAML object file and run the `oc create -f <file-name>.yaml` command, as shown.
To install the Cluster Logging Operator using the OpenShift Container Platform web console:

1. Create a Namespace for the Cluster Logging Operator. You must use the CLI to create the Namespace.
   a. Create a Namespace object YAML file (for example, clo-namespace.yaml) for the Cluster Logging Operator:

   ```yaml
   apiVersion: v1
   kind: Namespace
   metadata:
     name: openshift-logging
   annotations:
     openshift.io/node-selector: ""
   labels:
     openshift.io/cluster-monitoring: "true"
   ```
   
   Specify these values as shown.

   b. Create the Namespace:

   ```shell
   $ oc create -f <file-name>.yaml
   
   For example:
   $ oc create -f clo-namespace.yaml
   ```

2. Install the Cluster Logging Operator:
   b. Choose Cluster Logging from the list of available Operators, and click Install.
   c. On the Create Operator Subscription page, under A specific Namespace on the cluster select openshift-logging. Then, click Subscribe.

3. Verify that the Cluster Logging Operator installed:
   a. Switch to the Operators → Installed Operators page.
   b. Ensure that Cluster Logging is listed in the openshift-logging project with a Status of InstallSucceeded.

   **NOTE**

   During installation an Operator might display a Failed status. If the Operator then installs with an InstallSucceeded message, you can safely ignore the Failed message.

   If the Operator does not appear as installed, to troubleshoot further:
   - Switch to the Operators → Installed Operators page and inspect the Status column for any errors or failures.
• Switch to the Workloads → Pods page and check the logs in any Pods in the openshift-logging and openshift-operators-redhat projects that are reporting issues.

4. Create a cluster logging instance:
   a. Switch to the Administration → Custom Resource Definitions page.
   c. On the Custom Resource Definition Overview page, select View Instances from the Actions menu.
   d. On the Cluster Loggings page, click Create Cluster Logging.
      You might have to refresh the page to load the data.
   e. In the YAML field, replace the code with the following:

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance" 1
     namespace: "openshift-logging"
   spec:
     managementState: "Managed" 2
     logStore:
       type: "elasticsearch" 3
       elasticsearch:
         nodeCount: 3 4
         storage:
           storageClassName: gp2 5
           size: 200G
           redundancyPolicy: "SingleRedundancy"
     visualization:
       type: "kibana" 6
       kibana:
         replicas: 1
     curation:
       type: "curator" 7
       curator:
         schedule: "30 3 * * *"
     collection:
       logs:
         type: "fluentd" 8
         fluentd: {}
   ```

   **NOTE**

   This default cluster logging configuration should support a wide array of environments. Review the topics on tuning and configuring the cluster logging components for information on modifications you can make to your cluster logging cluster.

1 The name must be instance.
2. The cluster logging management state. In most cases, if you change the cluster logging defaults, you must set this to **Unmanaged**. However, an unmanaged deployment does

3. Settings for configuring Elasticsearch. Using the CR, you can configure shard replication policy and persistent storage. For more information, see *Configuring Elasticsearch*.

4. Specify the number of Elasticsearch nodes. See the note that follows this list.

5. Specify that each Elasticsearch node in the cluster is bound to a Persistent Volume Claim.

6. Settings for configuring Kibana. Using the CR, you can scale Kibana for redundancy and configure the CPU and memory for your Kibana nodes. For more information, see *Configuring Kibana*.

7. Settings for configuring Curator. Using the CR, you can set the Curator schedule. For more information, see *Configuring Curator*.

8. Settings for configuring Fluentd. Using the CR, you can configure Fluentd CPU and memory limits. For more information, see *Configuring Fluentd*.

**NOTE**

The maximum number of Elasticsearch master nodes is three. If you specify a nodeCount greater than 3, OpenShift Container Platform creates three Elasticsearch nodes that are Master-eligible nodes, with the master, client, and data roles. The additional Elasticsearch nodes are created as Data-only nodes, using client and data roles. Master nodes perform cluster-wide actions such as creating or deleting an index, shard allocation, and tracking nodes. Data nodes hold the shards and perform data-related operations such as CRUD, search, and aggregations. Data-related operations are I/O-, memory-, and CPU-intensive. It is important to monitor these resources and to add more Data nodes if the current nodes are overloaded.

For example, if nodeCount=4, the following nodes are created:

```bash
$ oc get deployment

cluster-logging-operator       1/1     1            1           18h
elasticsearch-cd-x6kdekli-1    0/1     1            0           6m54s
elasticsearch-cdm-x6kdekli-1   1/1     1            1           18h
elasticsearch-cdm-x6kdekli-2   0/1     1            0           6m49s
elasticsearch-cdm-x6kdekli-3   0/1     1            0           6m44s
```

The number of primary shards for the index templates is equal to the number of Elasticsearch data nodes.

f. Click **Create**. This creates the Cluster Logging Custom Resource and Elasticsearch Custom Resource, which you can edit to make changes to your cluster logging cluster.

5. Verify the install:

   a. Switch to the **Workloads → Pods** page.
b. Select the **openshift-logging** project. You should see several Pods for cluster logging, Elasticsearch, Fluentd, and Kibana similar to the following list:

- cluster-logging-operator-cb795f8dc-xkckc
- elasticsearch-cdm-b3nqzchd-1-5c6797-67kfq
- elasticsearch-cdm-b3nqzchd-2-6667f4-wtprv
- elasticsearch-cdm-b3nqzchd-3-588c65-clg7g
- fluentd-2c7dg
- fluentd-9z7kk
- fluentd-br7r2
- fluentd-fn2sb
- fluentd-pb2f8
- fluentd-zqgqx
- kibana-7fb4fd4cc9-bvt4p

### 3.3. INSTALL THE CLUSTER LOGGING OPERATOR USING THE CLI

You can use the OpenShift Container Platform CLI to install the Cluster Logging Operator. The Cluster Logging Operator creates and manages the components of the logging stack.

**Procedure**

To install the Cluster Logging Operator using the CLI:

1. Create a Namespace for the Cluster Logging Operator:

   a. Create a Namespace object YAML file (for example, `clo-namespace.yaml`) for the Cluster Logging Operator:

   ```yaml
   apiVersion: v1
   kind: Namespace
   metadata:
     name: openshift-logging
   annotations:
     openshift.io/node-selector: ""
   labels:
     openshift.io/cluster-monitoring: "true"
   
   ``

   b. Create the Namespace:

   ```bash
   $ oc create -f <file-name>.yaml
   
   For example:
   
   $ oc create -f clo-namespace.yaml
   ```
2. Install the Cluster Logging Operator by creating the following objects:

a. Create an OperatorGroup object YAML file (for example, clo-og.yaml) for the Cluster Logging Operator:

```yaml
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: cluster-logging
namespace: openshift-logging
spec:
targetNamespaces:
  - openshift-logging
```

1. You must specify the `openshift-logging` namespace.

b. Create the OperatorGroup object:

```
$ oc create -f <file-name>.yaml
```

For example:
```
$ oc create -f clo-og.yaml
```

c. Create a Subscription object YAML file (for example, clo-sub.yaml) to subscribe a Namespace to an Operator.

**Example Subscription**

```yaml
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: cluster-logging
namespace: openshift-logging
spec:
  channel: "4.3"
  name: cluster-logging
  source: redhat-operators
  sourceNamespace: openshift-marketplace
```

1. You must specify the `openshift-logging` Namespace.

2. Specify 4.3 as the channel.

3. Specify `redhat-operators`. If your OpenShift Container Platform cluster is installed on a restricted network, also known as a disconnected cluster, specify the name of the CatalogSource object you created when you configured the Operator Lifecycle Manager (OLM).

d. Create the Subscription object:

```
$ oc create -f <file-name>.yaml
```
For example:

```
$ oc create -f clo-sub.yaml
```

The Cluster Logging Operator is installed to the `openshift-logging` Namespace.

3. Verify the Operator installation.
There should be a Cluster Logging Operator in the `openshift-logging` Namespace. The Version number might be different than shown.

```
oc get csv --all-namespaces
```

<table>
<thead>
<tr>
<th>NAMESPACE</th>
<th>NAME</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>openshift-logging</td>
<td>clusterlogging.4.3.1-202002032140</td>
<td>Cluster Logging</td>
</tr>
<tr>
<td></td>
<td>4.3.1-202002032140</td>
<td>Succeeded</td>
</tr>
</tbody>
</table>

4. Create a Cluster Logging instance:

a. Create an instance object YAML file (for example, `clo-instance.yaml`) for the Cluster Logging Operator:

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: "openshift-logging"
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 3
      storage:
        storageClassName: gp2
        size: 200G
        redundancyPolicy: "SingleRedundancy"
  visualization:
    type: "kibana"
    kibana:
      replicas: 1
  curation:
    type: "curator"  
```

**NOTE**

This default Cluster Logging configuration should support a wide array of environments. Review the topics on tuning and configuring the Cluster Logging components for information on modifications you can make to your Cluster Logging cluster.
The name must be **instance**.

2 The Cluster Logging management state. In most cases, if you change the Cluster Logging defaults, you must set this to **Unmanaged**. However, an unmanaged deployment does not receive updates until Cluster Logging is placed back into the **Managed** state. For more information, see Changing cluster logging management state.

3 Settings for configuring Elasticsearch. Using the Custom Resource (CR), you can configure shard replication policy and persistent storage. For more information, see Configuring Elasticsearch.

4 Specify the number of Elasticsearch nodes. See the note that follows this list.

5 Specify that each Elasticsearch node in the cluster is bound to a Persistent Volume Claim.

6 Settings for configuring Kibana. Using the CR, you can scale Kibana for redundancy and configure the CPU and memory for your Kibana nodes. For more information, see Configuring Kibana.

7 Settings for configuring Curator. Using the CR, you can set the Curator schedule. For more information, see Configuring Curator.

8 Settings for configuring Fluentd. Using the CR, you can configure Fluentd CPU and memory limits. For more information, see Configuring Fluentd.
NOTE

The maximum number of Elasticsearch master nodes is three. If you specify a `nodeCount` greater than 3, OpenShift Container Platform creates three Elasticsearch nodes that are Master-eligible nodes, with the master, client, and data roles. The additional Elasticsearch nodes are created as Data-only nodes, using client and data roles. Master nodes perform cluster-wide actions such as creating or deleting an index, shard allocation, and tracking nodes. Data nodes hold the shards and perform data-related operations such as CRUD, search, and aggregations. Data-related operations are I/O-, memory-, and CPU-intensive. It is important to monitor these resources and to add more Data nodes if the current nodes are overloaded.

For example, if `nodeCount=4`, the following nodes are created:

```
$ oc get deployment
```

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster-logging-operator</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>18h</td>
</tr>
<tr>
<td>elasticsearch-cd-x6kdekli-1</td>
<td>1/1</td>
<td>0</td>
<td></td>
<td>6m54s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-1</td>
<td>1/1</td>
<td>1</td>
<td>18h</td>
<td></td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-2</td>
<td>1/1</td>
<td>0</td>
<td></td>
<td>6m49s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-3</td>
<td>1/1</td>
<td>0</td>
<td></td>
<td>6m44s</td>
</tr>
</tbody>
</table>

The number of primary shards for the index templates is equal to the number of Elasticsearch data nodes.

b. Create the instance:

```
$ oc create -f <file-name>.yaml
```

For example:

```
$ oc create -f clo-instance.yaml
```

5. Verify the install by listing the Pods in the `openshift-logging` project.
   You should see several Pods for Cluster Logging, Elasticsearch, Fluentd, and Kibana similar to the following list:

```
oc get pods -n openshift-logging
```

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster-logging-operator-66f77ffccb-ppzbg</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>elasticsearch-cdm-ftuhduuw-1-fcc4b9566-q6bhp</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m40s</td>
</tr>
<tr>
<td>elasticsearch-cdm-ftuhduuw-2-7b4994dbfc-rd2gc</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m36s</td>
</tr>
<tr>
<td>elasticsearch-cdm-ftuhduuw-3-84b5ff7ff8-gqnm2</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m4s</td>
</tr>
<tr>
<td>fluentd-587vb</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m26s</td>
</tr>
<tr>
<td>fluentd-7mpb9</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m30s</td>
</tr>
<tr>
<td>fluentd-flm6j</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m33s</td>
</tr>
<tr>
<td>fluentd-gn4rn</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m26s</td>
</tr>
<tr>
<td>fluentd-nlgb6</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m30s</td>
</tr>
<tr>
<td>fluentd-snpkt</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>2m28s</td>
</tr>
<tr>
<td>kibana-d6d5668c5-rppqm</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m39s</td>
</tr>
</tbody>
</table>
3.4. ADDITIONAL RESOURCES

For more information on installing Operators, see Installing Operators from the OperatorHub.
CHAPTER 4. UPDATING CLUSTER LOGGING

After updating the OpenShift Container Platform cluster from 4.2 to 4.3, you must then upgrade cluster logging from 4.2 to 4.3.

4.1. UPDATING CLUSTER LOGGING

After updating the OpenShift Container Platform cluster, you can update cluster logging from 4.2 to 4.3 by updating the subscription for the Elasticsearch Operator and the Cluster Logging Operator.

**IMPORTANT**

Changes introduced by the new log forward feature modified the support for `out_forward` starting with the OpenShift Container Platform 4.3 release. In OpenShift Container Platform 4.3, you create a ConfigMap to configure `out_forward`. Any updates to the `secure-forward.conf` section of the Fluentd ConfigMap are removed.

If you use the `out_forward` plug-in, before updating, you can copy your current `secure-forward.conf` section from the Fluentd ConfigMap and use the copied data when you create the `secure-forward` ConfigMap.

Prerequisites

- Update the cluster from 4.2 to 4.3.
- Make sure the cluster logging status is healthy:
  - All Pods are ready.
  - Elasticsearch cluster is healthy.
- Optionally, copy your current `secure-forward.conf` section from the Fluentd ConfigMap for use if you want to create the `secure-forward` ConfigMap. See the note above.

Procedure

1. Update the Elasticsearch Operator:
   a. From the web console, click Operators → Installed Operators.
   b. Select the openshift-logging project.
   c. Click the Elasticsearch Operator.
   d. Click Subscription → Channel.
   e. In the Change Subscription Update Channel window, select 4.3 and click Save.
   f. Wait for a few seconds, then click Operators → Installed Operators. The Elasticsearch Operator is shown as 4.3. For example:

```
Elasticsearch Operator
4.3.0-201909201915 provided by Red Hat, Inc
```
2. Update the Cluster Logging Operator:
   a. From the web console, click **Operators → Installed Operators**.
   b. Select the **openshift-logging** Project.
   c. Click the **Cluster Logging Operator**.
   d. Click **Subscription → Channel**.
   e. In the **Change Subscription Update Channel** window, select **4.3** and click **Save**.
   f. Wait for a few seconds, then click **Operators → Installed Operators**.
      The Cluster Logging Operator is shown as 4.3. For example:
      ```
      Cluster Logging
      4.3.0-201909201915 provided
      by Red Hat, Inc
      ```

3. Check the logging components:
   a. Ensure that the Elasticsearch Pods are using a 4.3 image:
      ```
      $ oc get pod -o yaml -n openshift-logging --selector component=elasticsearch |grep 'image:'
      image: registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3.0-202001081344
      image: registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3.0-202001081344
      image: registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3.0-202001081344
      ```
   b. Ensure that all Elasticsearch Pods are in the **Ready** status:
      ```
      $ oc get pod -n openshift-logging --selector component=elasticsearch
      NAME                                            READY   STATUS    RESTARTS   AGE
      elasticsearch-cdm-1pbrl44l-1-55b7546f4c-mshhk   2/2     Running   0          31m
      elasticsearch-cdm-1pbrl44l-2-5c6d87589f-gx5hk   2/2     Running   0          30m
      elasticsearch-cdm-1pbrl44l-3-88df5d47-m45jc     2/2     Running   0          29m
      ```
   c. Ensure that the Elasticsearch cluster is healthy:
      ```
      oc exec -n openshift-logging -c elasticsearch elasticsearch-cdm-1pbrl44l-1-55b7546f4c-mshhk -- es_cluster_health
      ```
"status" : "green",

....

d. Ensure that the logging collector Pods are using a 4.3 image:

```
$ oc get pod -n openshift-logging --selector logging-infra=fluentd -o yaml |grep 'image:
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-fluentd:v4.3.0-202001081344
```

e. Ensure that the Kibana Pods are using a 4.3 image:

```
$ oc get pod -n openshift-logging --selector logging-infra=kibana -o yaml |grep 'image:
image: registry.redhat.io/openshift4/ose-logging-kibana5:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-oauth-proxy:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-logging-kibana5:v4.3.0-202001081344
image: registry.redhat.io/openshift4/ose-oauth-proxy:v4.3.0-202001081344
```

f. Ensure that the Curator CronJob is using a 4.3 image:

```
$ oc get CronJob curator -n openshift-logging -o yaml |grep 'image:
image: registry.redhat.io/openshift4/ose-logging-curator5:v4.3.0-202001081344
```
CHAPTER 5. WORKING WITH EVENT ROUTER

The Event Router communicates with the OpenShift Container Platform and prints OpenShift Container Platform events to log of the pod where the event occurs.

If Cluster Logging is deployed, you can view the OpenShift Container Platform events in Kibana.

5.1. DEPLOYING AND CONFIGURING THE EVENT ROUTER

Use the following steps to deploy Event Router into your cluster.

The following Template object creates the Service Account, ClusterRole, and ClusterRoleBinding required for the Event Router.

Prerequisites

You need proper permissions to create service accounts and update cluster role bindings. For example, you can run the following template with a user that has the `cluster-admin` role.

Procedure

1. Create a template for the Event Router:

```yaml
kind: Template
apiVersion: v1
metadata:
  name: eventrouter-template
  annotations:
    description: "A pod forwarding kubernetes events to cluster logging stack."
    tags: "events, EFK, logging, cluster-logging"
objects:
  - kind: ServiceAccount
    apiVersion: v1
    metadata:
      name: eventrouter
      namespace: ${NAMESPACE}
  - kind: ClusterRole
    apiVersion: v1
    metadata:
      name: event-reader
    rules:
      - apiGroups: [""]
        resources: ["events"]
        verbs: ["get", "watch", "list"]
  - kind: ClusterRoleBinding
    apiVersion: v1
    metadata:
      name: event-reader-binding
    subjects:
      - kind: ServiceAccount
        name: eventrouter
        namespace: ${NAMESPACE}
        roleRef:
          kind: ClusterRole
          name: event-reader
```

OpenShift Container Platform 4.3 Logging
- kind: ConfigMap
  apiVersion: v1
  metadata:
    name: eventrouter
    namespace: ${NAMESPACE}
  data:
    config.json: |
    
    "sink": "stdout"

- kind: Deployment
  apiVersion: apps/v1
  metadata:
    name: eventrouter
    namespace: ${NAMESPACE}
  labels:
    component: eventrouter
    logging-infra: eventrouter
    provider: openshift
  spec:
    selector:
      matchLabels:
        component: eventrouter
        logging-infra: eventrouter
        provider: openshift
    replicas: 1
    template:
      metadata:
        labels:
          component: eventrouter
          logging-infra: eventrouter
          provider: openshift
        name: eventrouter
      spec:
        serviceAccount: eventrouter
        containers:
          - name: kube-eventrouter
            image: ${IMAGE}
            imagePullPolicy: IfNotPresent
            resources:
              limits:
                memory: ${MEMORY}
            requests:
              cpu: ${CPU}
              memory: ${MEMORY}
            volumeMounts:
              - name: config-volume
                mountPath: /etc/eventrouter
            volumes:
              - name: config-volume
                configMap:
                  name: eventrouter
      parameters:
        - name: IMAGE
          displayName: Image
          value: "registry.redhat.io/openshift4/ose-logging-eventrouter:latest"
- name: MEMORY
  displayName: Memory
  value: "128Mi"
- name: CPU
  displayName: CPU
  value: "100m"
- name: NAMESPACE
  displayName: Namespace
  value: "openshift-logging"

1. Creates a Service Account for the Event Router.
2. Creates a cluster role to monitor for events in the cluster.
3. Allows the get, watch, and list permissions for the events resource.
4. Creates a ClusterRoleBinding to bind the ClusterRole to the ServiceAccount.
5. Specify the image version for the Event Router.
6. Specify the memory limit for the Event Router pods. Defaults to '128Mi'.
7. Specify the minimum amount of CPU to allocate to the Event Router. Defaults to '100m'.
8. Specify the namespace where eventrouter is deployed. Defaults to openshift-logging. The value must be the same as specified for the ServiceAccount and ClusterRoleBinding. The project indicates where in Kibana you can locate events:
   - If the event router pod is deployed in a default project, such as kube-* and openshift-*, you can find the events under the .operation index.
   - If the event router pod is deployed in other projects, you can find the event under the index using the project namespace.

2. Use the following command to process and apply the template:

   $ oc process -f <templatefile> | oc apply -f -

   For example:

   $ oc process -f eventrouter.yaml | oc apply -f -

   serviceaccount/logging-eventrouter created
   clusterrole.authorization.openshift.io/event-reader created
   clusterrolebinding.authorization.openshift.io/event-reader-binding created
   configmap/logging-eventrouter created
   deployment.apps/logging-eventrouter created

3. Validate that the Event Router installed:

   $ oc get pods --selector component=eventrouter -o name

   pod/logging-eventrouter-d649f97c8-qvv8r
$ oc logs logging-eventrouter-d649f97c8-qvv8r

{"verb":"ADDED","event":{"metadata":{"name":"elasticsearch-operator.v0.0.1.158f402e25397146","namespace":"openshift-operators","selfLink":"/api/v1/namespaces/openshift-operators/events/elasticsearch-operator.v0.0.1.158f402e25397146","uid":"37b7ff11-4f1a-11e9-a7ad-0271b2ca69f0","resourceVersion":"523264","creationTimestamp":"2019-03-25T16:22:43Z"},"involvedObject":{"kind":"ClusterServiceVersion","namespace":"openshift-operators","name":"elasticsearch-operator.v0.0.1","uid":"27b2ca6d-4f1a-11e9-8fba-0ea949ad61f6","apiVersion":"operators.coreos.com/v1alpha1","resourceVersion":"523096"},"reason":"InstallSucceeded","message":"waiting for install components to report healthy","source":{"component":"operator-lifecycle-manager"},"firstTimestamp":"2019-03-25T16:22:43Z","lastTimestamp":"2019-03-25T16:22:43Z","count":1,"type":"Normal"}
CHAPTER 6. VIEWING CLUSTER LOGS

You can view OpenShift Container Platform cluster logs in the CLI or OpenShift Container Platform web console.

6.1. VIEWING CLUSTER LOGS

You can view cluster logs in the CLI.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

To view cluster logs:

1. Determine if the log location is a file or CONSOLE (stdout).

   $ oc -n openshift-logging set env daemonset/fluentd --list | grep LOGGING_FILE_PATH

2. Depending on the log location, execute the logging command:

   - If LOGGING_FILE_PATH points to a file, the default, use the logs utility, from the project, where the pod is located, to print out the contents of Fluentd log files:

     $ oc exec <any-fluentd-pod> -- logs

     Specify the name of a log collector pod. Note the space before logs.

     For example:

     $ oc exec fluentd-ht42r -n openshift-logging -- logs

   - If you are using LOGGING_FILE_PATH=console, the log collector writes logs to stdout/stderr. You can retrieve the logs with the oc logs [-f] <pod_name> command, where the -f is optional.

     $ oc logs -f <any-fluentd-pod> -n openshift-logging

     Specify the name of a log collector pod. Use the -f option to follow what is being written into the logs.

     For example

     $ oc logs -f fluentd-ht42r -n openshift-logging

     The contents of log files are printed out.

     By default, Fluentd reads logs from the tail, or end, of the log.
6.2. VIEWING CLUSTER LOGS IN THE OPENShift CONTAINER PLATFORM WEB CONSOLE

You can view cluster logs in the OpenShift Container Platform web console.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

To view cluster logs:

1. In the OpenShift Container Platform console, navigate to Workloads → Pods.
2. Select the openshift-logging project from the drop-down menu.
3. Click one of the logging collector pods with the fluentd prefix.
4. Click Logs.

By default, Fluentd reads logs from the tail, or end, of the log.
CHAPTER 7. VIEWING CLUSTER LOGS USING KIBANA

The cluster logging installation deploys the Kibana web console.

7.1. LAUNCHING KIBANA

Kibana is a browser-based console to query, discover, and visualize your logs through histograms, line graphs, pie charts, heat maps, built-in geospatial support, and other visualizations.

Procedure

To launch Kibana:

1. In the OpenShift Container Platform console, click Monitoring → Logging.

2. Log in using the same credentials you use to log in to the OpenShift Container Platform console.
   The Kibana interface launches. You can now:
   - Search and browse your data using the Discover page.
   - Chart and map your data using the Visualize page.
   - Create and view custom dashboards using the Dashboard page.

Use and configuration of the Kibana interface is beyond the scope of this documentation. For more information, on using the interface, see the Kibana documentation.
8.1. ABOUT CONFIGURING CLUSTER LOGGING

After installing cluster logging into your OpenShift Container Platform cluster, you can make the following configurations.

NOTE
You must set cluster logging to Unmanaged state before performing these configurations, unless otherwise noted. For more information, see Changing the cluster logging management state.

8.1.1. About deploying and configuring cluster logging

OpenShift Container Platform cluster logging is designed to be used with the default configuration, which is tuned for small to medium sized OpenShift Container Platform clusters.

The installation instructions that follow include a sample Cluster Logging Custom Resource (CR), which you can use to create a cluster logging instance and configure your cluster logging deployment.

If you want to use the default cluster logging install, you can use the sample CR directly.

If you want to customize your deployment, make changes to the sample CR as needed. The following describes the configurations you can make when installing your cluster logging instance or modify after installation. See the Configuring sections for more information on working with each component, including modifications you can make outside of the Cluster Logging Custom Resource.

8.1.1.1. Configuring and Tuning Cluster Logging

You can configure your cluster logging environment by modifying the Cluster Logging Custom Resource deployed in the openshift-logging project.

You can modify any of the following components upon install or after install:

Memory and CPU
You can adjust both the CPU and memory limits for each component by modifying the resources block with valid memory and CPU values:

```
spec:
  logStore:
    elasticsearch:
      resources:
        limits:
          cpu:
          memory:
        requests:
          cpu: 1
          memory: 16Gi
        type: "elasticsearch"
  collection:
    logs:
```
Elasticsearch storage

You can configure a persistent storage class and size for the Elasticsearch cluster using the `storageClass name` and `size` parameters. The Cluster Logging Operator creates a `PersistentVolumeClaim` for each data node in the Elasticsearch cluster based on these parameters.

This example specifies each data node in the cluster will be bound to a `PersistentVolumeClaim` that requests "200G" of "gp2" storage. Each primary shard will be backed by a single replica.
NOTE

Omitting the `storage` block results in a deployment that includes ephemeral storage only.

```yaml
spec:
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 3
      storage: {}
```

Elasticsearch replication policy

You can set the policy that defines how Elasticsearch shards are replicated across data nodes in the cluster:

- **FullRedundancy.** The shards for each index are fully replicated to every data node.
- **MultipleRedundancy.** The shards for each index are spread over half of the data nodes.
- **SingleRedundancy.** A single copy of each shard. Logs are always available and recoverable as long as at least two data nodes exist.
- **ZeroRedundancy.** No copies of any shards. Logs may be unavailable (or lost) in the event a node is down or fails.

Curator schedule

You specify the schedule for Curator in the **cron format**.

```yaml
spec:
  curation:
    type: "curator"
    resources:
      curator:
        schedule: "30 3 * * *"
```

8.1.1.2. Sample modified Cluster Logging Custom Resource

The following is an example of a Cluster Logging Custom Resource modified using the options previously described.

Sample modified Cluster Logging Custom Resource

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: "openshift-logging"
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 2
```
In order to modify certain components managed by the Cluster Logging Operator or the Elasticsearch Operator, you must set the operator to the unmanaged state.

In unmanaged state, the operators do not respond to changes in the CRs. The administrator assumes full control of individual component configurations and upgrades when in unmanaged state.

In managed state, the Cluster Logging Operator (CLO) responds to changes in the Cluster Logging Custom Resource (CR) and adjusts the logging deployment accordingly.

The OpenShift Container Platform documentation indicates in a prerequisite step when you must set the OpenShift Container Platform cluster to Unmanaged.
NOTE

If you set the Elasticsearch Operator (EO) to unmanaged and leave the Cluster Logging Operator (CLO) as managed, the CLO will revert changes you make to the EO, as the EO is managed by the CLO.

8.2.1. Changing the cluster logging management state

You must set the operator to the unmanaged state in order to modify the components managed by the Cluster Logging Operator:

- the Curator CronJob,
- the Elasticsearch CR,
- the Kibana Deployment,
- the log collector DaemonSet.

If you make changes to these components in managed state, the Cluster Logging Operator reverts those changes.

NOTE

An unmanaged cluster logging environment does not receive updates until you return the Cluster Logging Operator to Managed state.

Prerequisites

- The Cluster Logging Operator must be installed.

Procedure

1. Edit the Cluster Logging Custom Resource (CR) in the openshift-logging project:

   ```bash
   $ oc edit ClusterLogging instance
   $ oc edit ClusterLogging instance
   ```

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
   ....
   spec:
     managementState: "Managed" ①
   ```

   ① Specify the management state as Managed or Unmanaged.

8.2.2. Changing the Elasticsearch management state
You must set the operator to the *unmanaged* state in order to modify the Elasticsearch deployment files, which are managed by the Elasticsearch Operator.

If you make changes to these components in managed state, the Elasticsearch Operator reverts those changes.

**NOTE**

An unmanaged Elasticsearch cluster does not receive updates until you return the Elasticsearch Operator to Managed state.

**Prerequisite**

- The Elasticsearch Operator must be installed.
- Have the name of the Elasticsearch CR, in the `openshift-logging` project:

```
$ oc get -n openshift-logging Elasticsearch
NAME    AGE
elasticsearch 28h
```

**Procedure**

Edit the Elasticsearch Custom Resource (CR) in the `openshift-logging` project:

```
$ oc edit Elasticsearch elasticsearch
apiVersion: logging.openshift.io/v1
kind: Elasticsearch
metadata:
  name: elasticsearch
...

spec:
  managementState: "Managed"

1 Specify the management state as **Managed** or **Unmanaged**.

**NOTE**

If you set the Elasticsearch Operator (EO) to unmanaged and leave the Cluster Logging Operator (CLO) as managed, the CLO will revert changes you make to the EO, as the EO is managed by the CLO.

### 8.3. CONFIGURING CLUSTER LOGGING

Cluster logging is configurable using a Cluster Logging Custom Resource (CR) deployed in the `openshift-logging` project.

The Cluster Logging Operator watches for changes to Cluster Logging CRs, creates any missing logging components, and adjusts the logging deployment accordingly.
The Cluster Logging CR is based on the Cluster Logging Custom Resource Definition (CRD), which defines a complete cluster logging deployment and includes all the components of the logging stack to collect, store and visualize logs.

Sample Cluster Logging Custom Resource (CR)

```yaml
apiVersion: logging.openshift.io/v1
kind: ClusterLogging
metadata:
  creationTimestamp: '2019-03-20T18:07:02Z'
  generation: 1
  name: instance
  namespace: openshift-logging
spec:
  collection:
    logs:
      fluentd:
        resources: null
      type: fluentd
  curation:
    curator:
      resources: null
      schedule: 30 3 * * *
      type: curator
  logStore:
    elasticsearch:
      nodeCount: 3
      redundancyPolicy: SingleRedundancy
      resources:
        limits:
          cpu:
          memory:
        requests:
          cpu:
          memory:
        storage: {}
      type: elasticsearch
  managementState: Managed
  visualization:
    kibana:
    proxy:
      resources: null
      replicas: 1
      resources: null
    type: kibana
```

You can configure the following for cluster logging:

- You can place cluster logging into an unmanaged state that allows an administrator to assume full control of individual component configurations and upgrades.
- You can overwrite the image for each cluster logging component by modifying the appropriate environment variable in the `cluster-logging-operator` Deployment.
- You can specify specific nodes for the logging components using node selectors.
8.3.1. Understanding the cluster logging component images

There are several components in cluster logging, each one implemented with one or more images. Each image is specified by an environment variable defined in the `cluster-logging-operator` deployment in the `openshift-logging` project and should not be changed.

You can view the images by running the following command:

```
$ oc -n openshift-logging set env deployment/cluster-logging-operator --list | grep _IMAGE
```

1. `ELASTICSEARCH_IMAGE=registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3` deploys Elasticsearch.

The values might be different depending on your environment.

8.4. CONFIGURING ELASTICSEARCH TO STORE AND ORGANIZE LOG DATA

OpenShift Container Platform uses Elasticsearch (ES) to store and organize the log data.

Some of the modifications you can make to your Elasticsearch deployment include:

- storage for your Elasticsearch cluster;
- how shards are replicated across data nodes in the cluster, from full replication to no replication;
- allowing external access to Elasticsearch data.

**NOTE**

Scaling down Elasticsearch nodes is not supported. When scaling down, Elasticsearch pods can be accidentally deleted, possibly resulting in shards not being allocated and replica shards being lost.

Elasticsearch is a memory-intensive application. Each Elasticsearch node needs 16G of memory for both memory requests and limits, unless you specify otherwise in the Cluster Logging Custom Resource. The initial set of OpenShift Container Platform nodes might not be large enough to support the Elasticsearch cluster. You must add additional nodes to the OpenShift Container Platform cluster to run with the recommended or higher memory.
Each Elasticsearch node can operate with a lower memory setting though this is not recommended for production deployments.

**NOTE**

If you set the Elasticsearch Operator (EO) to unmanaged and leave the Cluster Logging Operator (CLO) as managed, the CLO will revert changes you make to the EO, as the EO is managed by the CLO.

### 8.4.1. Configuring Elasticsearch CPU and memory limits

Each component specification allows for adjustments to both the CPU and memory limits. You should not have to manually adjust these values as the Elasticsearch Operator sets values sufficient for your environment.

Each Elasticsearch node can operate with a lower memory setting though this is **not** recommended for production deployments. For production use, you should have no less than the default 16Gi allocated to each Pod. Preferably you should allocate as much as possible, up to 64Gi per Pod.

**Prerequisites**

- Cluster logging and Elasticsearch must be installed.

**Procedure**

1. Edit the Cluster Logging Custom Resource (CR) in the `openshift-logging` project:

   ```
   $ oc edit ClusterLogging instance
   
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
   ....
   spec:
     logStore:
       type: "elasticsearch"
     elasticsearch:
       resources:
         limits:
           memory: "16Gi"
         requests:
           cpu: "1"
           memory: "16Gi"
   ```

   Specify the CPU and memory limits as needed. If you leave these values blank, the Elasticsearch Operator sets default values that should be sufficient for most deployments.

   If you adjust the amount of Elasticsearch CPU and memory, you must change both the request value and the limit value.

   For example:
Kubernetes generally adheres the node CPU configuration and DOES not allow Elasticsearch to use the specified limits. Setting the same value for the requests and limits ensures that Elasticsearch can use the CPU and memory you want, assuming the node has the CPU and memory available.

8.4.2. Configuring Elasticsearch replication policy

You can define how Elasticsearch shards are replicated across data nodes in the cluster.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Edit the Cluster Logging Custom Resource (CR) in the openshift-logging project:

   ```yaml
   oc edit clusterlogging instance
   ```

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
   ....
   
   spec:
     logStore:
       type: "elasticsearch"
       elasticsearch:
         redundancyPolicy: "SingleRedundancy"
   ```

   Specify a redundancy policy for the shards. The change is applied upon saving the changes.

   - **FullRedundancy.** Elasticsearch fully replicates the primary shards for each index to every data node. This provides the highest safety, but at the cost of the highest amount of disk required and the poorest performance.

   - **MultipleRedundancy.** Elasticsearch fully replicates the primary shards for each index to half of the data nodes. This provides a good tradeoff between safety and performance.

   - **SingleRedundancy.** Elasticsearch makes one copy of the primary shards for each index. Logs are always available and recoverable as long as at least two data nodes exist. Better performance than MultipleRedundancy, when using 5 or more nodes. You
cannot apply this policy on deployments of single Elasticsearch node.

- **ZeroRedundancy.** Elasticsearch does not make copies of the primary shards. Logs might be unavailable or lost in the event a node is down or fails. Use this mode when you are more concerned with performance than safety, or have implemented your own disk/PVC backup/restore strategy.

**NOTE**

The number of primary shards for the index templates is equal to the number of Elasticsearch data nodes.

### 8.4.3. Configuring Elasticsearch storage

Elasticsearch requires persistent storage. The faster the storage, the faster the Elasticsearch performance.

**Prerequisites**

- Cluster logging and Elasticsearch must be installed.

**Procedure**

1. Edit the Cluster Logging CR to specify that each data node in the cluster is bound to a Persistent Volume Claim.

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
...

spec:
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 3
      storage:
        storageClassName: "gp2"
        size: "200G"
```

This example specifies each data node in the cluster is bound to a Persistent Volume Claim that requests "200G" of AWS General Purpose SSD (gp2) storage.

### 8.4.4. Configuring Elasticsearch for emptyDir storage

You can use emptyDir with Elasticsearch, which creates an ephemeral deployment in which all of a pod’s data is lost upon restart.

**NOTE**

When using emptyDir, if Elasticsearch is restarted or redeployed, you will lose data.
Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Edit the Cluster Logging CR to specify emptyDir:

```yaml
spec:
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 3
      storage: {}
```

8.4.5. Exposing Elasticsearch as a route

By default, Elasticsearch deployed with cluster logging is not accessible from outside the logging cluster. You can enable a route with re-encryption termination for external access to Elasticsearch for those tools that access its data.

Externally, you can access Elasticsearch by creating a reencrypt route, your OpenShift Container Platform token and the installed Elasticsearch CA certificate. Then, access an Elasticsearch node with a cURL request that contains:

- The **Authorization: Bearer ${token}**
- The Elasticsearch reencrypt route and an **Elasticsearch API request**.

Internally, you can access Elasticsearch using the Elasticsearch cluster IP:

You can get the Elasticsearch cluster IP using either of the following commands:

```bash
$ oc get service elasticsearch -o jsonpath={.spec.clusterIP} -n openshift-logging
172.30.183.229
```

```
oc get service elasticsearch
NAME       TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)    AGE
elasticsearch ClusterIP   172.30.183.229 <none>        9200/TCP   22h
```

```bash
```

% Total  % Received % Xferd  Average Speed   Time    Time     Time  Current
                  Dload  Upload   Total   Spent    Left  Speed
100    29   100  29    0     0    108      0 --:--:-- --:--:-- --:--:--   108

Prerequisites

- Cluster logging and Elasticsearch must be installed.
- You must have access to the project in order to be able to access to the logs.
Procedure

To expose Elasticsearch externally:

1. Change to the `openshift-logging` project:

   ```bash
   $ oc project openshift-logging
   ```

2. Extract the CA certificate from Elasticsearch and write to the `admin-ca` file:

   ```bash
   $ oc extract secret/elasticsearch --to=. --keys=admin-ca
   ```

3. Create the route for the Elasticsearch service as a YAML file:
   a. Create a YAML file with the following:

   ```yaml
   apiVersion: route.openshift.io/v1
   kind: Route
   metadata:
     name: elasticsearch
     namespace: openshift-logging
   spec:
     host: to:
       kind: Service
       name: elasticsearch
     tls:
       termination: reencrypt
       destinationCA Certificate: |
   ```

   1. Add the Elasticsearch CA certificate or use the command in the next step. You do not have to set the `spec.tls.key`, `spec.tls.certificate`, and `spec.tls.caCertificate` parameters required by some reencrypt routes.

   b. Run the following command to add the Elasticsearch CA certificate to the route YAML you created:

   ```bash
   cat ./admin-ca | sed -e "s/^/      /" >> <file-name>.yaml
   ```

   c. Create the route:

   ```bash
   $ oc create -f <file-name>.yaml
   route.route.openshift.io/elasticsearch created
   ```

4. Check that the Elasticsearch service is exposed:
   a. Get the token of this ServiceAccount to be used in the request:

   ```bash
   $ token=$(oc whoami -t)
   ```

   b. Set the `elasticsearch` route you created as an environment variable.
To verify the route was successfully created, run the following command that accesses Elasticsearch through the exposed route:

```bash
curl -tlsv1.2 --insecure -H "Authorization: Bearer $\{token\}" "https://$\{routeES\}/.operations/_search?size=1" | jq
```

The response appears similar to the following:

```
{
  "took": 441,
  "timed_out": false,
  "_shards": {
    "total": 3,
    "successful": 3,
    "skipped": 0,
    "failed": 0
  },
  "hits": {
    "total": 89157,
    "max_score": 1,
    "hits": [
      {
        "_index": "operations.2019.03.15",
        "_type": "com.example.viaq.common",
        "_id": "ODdiNWIyYzAtMjg5Ni0TAtNWE3MDY1MjMzNTc3",
        "_score": 1,
        "_source": {
          "_SOURCE_MONOTONIC_TIMESTAMP": "673396",
          "systemd": {
            "t": {
              "BOOT_ID": "246c34ee9cdeecb41a608e94",
              "MACHINE_ID": "e904a0bb5efd3e36badee0c",
              "TRANSPORT": "kernel"
            },
            "u": {
              "SYSLOG_FACILITY": "0",
              "SYSLOG_IDENTIFIER": "kernel"
            }
          },
          "level": "info",
          "message": "acpiphp: Slot [30] registered",
          "hostname": "localhost.localdomain",
          "pipeline_metadata": {
            "collector": {
              "ipaddr4": "10.128.2.12",
              "ipaddr6": "fe80::xx:xxxx:fe4c:5b09",
              "inputname": "fluent-plugin-systemd",
              "name": "fluentd",
              "received_at": "2019-03-15T20:25:06.273017+00:00",
              "version": "1.3.2 1.6.0"
            }
          }
        }
      }
    ]
  }
}
```
8.4.6. About Elasticsearch alerting rules

You can view these alerting rules in Prometheus.

<table>
<thead>
<tr>
<th>Alert</th>
<th>Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ElasticsearchClusterNotHealthy</td>
<td>Cluster health status has been RED for at least 2m. Cluster does not accept writes, shards may be missing or master node hasn’t been elected yet.</td>
<td>critical</td>
</tr>
<tr>
<td>ElasticsearchClusterNotHealthy</td>
<td>Cluster health status has been YELLOW for at least 20m. Some shard replicas are not allocated.</td>
<td>warning</td>
</tr>
<tr>
<td>ElasticsearchBulkRequestsRejectionJumps</td>
<td>High Bulk Rejection Ratio at node in cluster. This node may not be keeping up with the indexing speed.</td>
<td>warning</td>
</tr>
<tr>
<td>ElasticsearchNodeDiskWatermarkReached</td>
<td>Disk Low Watermark Reached at node in cluster. Shards can not be allocated to this node anymore. You should consider adding more disk space to the node.</td>
<td>alert</td>
</tr>
<tr>
<td>ElasticsearchNodeDiskWatermarkReached</td>
<td>Disk High Watermark Reached at node in cluster. Some shards will be re-allocated to different nodes if possible. Make sure more disk space is added to the node or drop old indices allocated to this node.</td>
<td>high</td>
</tr>
<tr>
<td>ElasticsearchJVMHeapUseHigh</td>
<td>JVM Heap usage on the node in cluster is &lt;value&gt;</td>
<td>alert</td>
</tr>
<tr>
<td>AggregatedLoggingSystemCPUHigh</td>
<td>System CPU usage on the node in cluster is &lt;value&gt;</td>
<td>alert</td>
</tr>
<tr>
<td>ElasticsearchProcessCPUHigh</td>
<td>ES process CPU usage on the node in cluster is &lt;value&gt;</td>
<td>alert</td>
</tr>
</tbody>
</table>

8.5. CONFIGURING KIBANA

OpenShift Container Platform uses Kibana to display the log data collected by Fluentd and indexed by Elasticsearch.

You can scale Kibana for redundancy and configure the CPU and memory for your Kibana nodes.
NOTE
You must set cluster logging to Unmanaged state before performing these configurations, unless otherwise noted. For more information, see Changing the cluster logging management state.

8.5.1. Configure Kibana CPU and memory limits

Each component specification allows for adjustments to both the CPU and memory limits.

Procedure

1. Edit the Cluster Logging Custom Resource (CR) in the openshift-logging project:

```
$ oc edit ClusterLogging instance
```

```
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"

spec:
  visualization:
    type: "kibana"
  kibana:
    replicas:
      resources:
        limits:
          memory: 1Gi
          cpu: 500m
          memory: 1Gi
        requests:
          memory: 100Mi
          cpu: 100m
          memory: 100Mi

```

1 Specify the CPU and memory limits to allocate for each node.

2 Specify the CPU and memory limits to allocate to the Kibana proxy.

8.5.2. Scaling Kibana for redundancy

You can scale the Kibana deployment for redundancy.

Procedure

1. Edit the Cluster Logging Custom Resource (CR) in the openshift-logging project:
$ oc edit ClusterLogging instance

apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"

spec:
  visualization:
    type: "kibana"
    kibana:
      replicas: 1

Specify the number of Kibana nodes.

8.5.3. Using tolerations to control the Kibana Pod placement

You can control which nodes the Kibana Pods run on and prevent other workloads from using those nodes by using tolerations on the Pods.

You apply tolerations to the Kibana Pods through the Cluster Logging Custom Resource (CR) and apply taints to a node through the node specification. A taint on a node is a key:value pair that instructs the node to repel all Pods that do not tolerate the taint. Using a specific key:value pair that is not on other Pods ensures only the Kibana Pod can run on that node.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Use the following command to add a taint to a node where you want to schedule the Kibana Pod:

   $ oc adm taint nodes <node-name> <key>=<value>:<effect>

   For example:

   $ oc adm taint nodes node1 kibana=node:NoExecute

   This example places a taint on node1 that has key kibana, value node, and taint effect NoExecute. You must use the NoExecute taint effect. NoExecute schedules only Pods that match the taint and remove existing Pods that do not match.

2. Edit the visualization section of the Cluster Logging Custom Resource (CR) to configure a toleration for the Kibana Pod:

   visualization:
   type: "kibana"
   kibana:
Specify the key that you added to the node.

Specify the `Exists` operator to require the `key/value/effect` parameters to match.

Specify the `NoExecute` effect.

Optionally, specify the `tolerationSeconds` parameter to set how long a Pod can remain bound to a node before being evicted.

This toleration matches the taint created by the `oc adm taint` command. A Pod with this toleration would be able to schedule onto `node1`.

### 8.5.4. Installing the Kibana Visualize tool

Kibana’s **Visualize** tab enables you to create visualizations and dashboards for monitoring container logs, allowing administrator users (**cluster-admin** or **cluster-reader**) to view logs by deployment, namespace, pod, and container.

#### Procedure

To load dashboards and other Kibana UI objects:

1. If necessary, get the Kibana route, which is created by default upon installation of the Cluster Logging Operator:

   ```bash
   $ oc get routes -n openshift-logging
   NAMESPACE                  NAME                       HOST/PORT
   PATH     SERVICES                   PORT    TERMINATION          WILDCARD
   openshift-logging          kibana                     kibana-openshift-logging.apps.openshift.com
   kibana                     <all>   reencrypt/Redirect   None
   ```

2. Get the name of your Elasticsearch pods.

   ```bash
   $ oc get pods -l component=elasticsearch
   NAME                                            READY   STATUS    RESTARTS   AGE
   elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6k    2/2     Running   0          22h
   elasticsearch-cdm-5ceex6ts-2-f799564cb-l9mj7    2/2     Running   0          22h
   elasticsearch-cdm-5ceex6ts-3-585968dc68-k7kjr   2/2     Running   0          22h
   ```

3. Create the necessary per-user configuration that this procedure requires:

   a. Log in to the Kibana dashboard as the user you want to add the dashboards to.

   ```bash
   https://kibana-openshift-logging.apps.openshift.com
   ```

   Where the URL is Kibana route.
b. If the Authorize Access page appears, select all permissions and click Allow selected permissions.

c. Log out of the Kibana dashboard.

4. Run the following command from the project where the pod is located using the name of any of your Elasticsearch pods:

```bash
$ oc exec <es-pod> -- es_load_kibana_ui_objects <user-name>
```

For example:

```bash
$ oc exec elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6k -- es_load_kibana_ui_objects <user-name>
```

NOTE

The metadata of the Kibana objects such as visualizations, dashboards, and so forth are stored in Elasticsearch with the `.kibana.{user_hash}` index format. You can obtain the user_hash using the `userhash=$(echo -n $username | sha1sum | awk '{print $1}')` command. By default, the Kibana shared_ops index mode enables all users with cluster admin roles to share the index, and this Kibana object metadata is saved to the `.kibana` index.

Any custom dashboard can be imported for a particular user either by using the import/export feature or by inserting the metadata onto the Elasticsearch index using the curl command.

### 8.6. CURATION OF ELASTICSEARCH DATA

The Elasticsearch Curator tool performs scheduled maintenance operations on a global and/or on a per-project basis. Curator performs actions based on its configuration.

The Cluster Logging Operator installs Curator and its configuration. You can configure the Curator cron schedule using the Cluster Logging Custom Resource and further configuration options can be found in the Curator ConfigMap, curator in the openshift-logging project, which incorporates the Curator configuration file, curator5.yaml and an OpenShift Container Platform custom configuration file, config.yaml.

OpenShift Container Platform uses the config.yaml internally to generate the Curator action file.

Optionally, you can use the action file, directly. Editing this file allows you to use any action that Curator has available to it to be run periodically. However, this is only recommended for advanced users as modifying the file can be destructive to the cluster and can cause removal of required indices/settings from Elasticsearch. Most users only must modify the Curator configuration map and never edit the action file.

#### 8.6.1. Configuring the Curator schedule

You can specify the schedule for Curator using the cluster logging Custom Resource created by the cluster logging installation.

**Prerequisites**
• Cluster logging and Elasticsearch must be installed.

Procedure
To configure the Curator schedule:

1. Edit the Cluster Logging Custom Resource in the openshift-logging project:

   ```
   $ oc edit clusterlogging instance
   ```

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
   ...
   curation:
     curator:
       schedule: 30 3 * * 1
       type: curator
   ```

   1. Specify the schedule for Curator in cron format.

   **NOTE**
   The time zone is set based on the host node where the Curator pod runs.

8.6.2. Configuring Curator index deletion

You can configure Curator to delete Elasticsearch data based on retention settings. You can configure per-project and global settings. Global settings apply to any project not specified. Per-project settings override global settings.

Prerequisite

• Cluster logging must be installed.

Procedure
To delete indices:

1. Edit the OpenShift Container Platform custom Curator configuration file:

   ```
   $ oc edit configmap/curator
   ```

2. Set the following parameters as needed:

   ```yaml
   config.yaml: |
   project_name:
     action
     unit:value
   ```

   The available parameters are:
Table 8.1. Project options

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>project_name</td>
<td>The actual name of a project, such as <code>myapp-devel</code>. For OpenShift Container Platform operations logs, use the name <code>operations</code> as the project name.</td>
</tr>
<tr>
<td>action</td>
<td>The action to take, currently only <code>delete</code> is allowed.</td>
</tr>
<tr>
<td>unit</td>
<td>The period to use for deletion, <code>days</code>, <code>weeks</code>, or <code>months</code>.</td>
</tr>
<tr>
<td>value</td>
<td>The number of units.</td>
</tr>
</tbody>
</table>

Table 8.2. Filter options

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.defaults</td>
<td>Use <code>.defaults</code> as the <code>project_name</code> to set the defaults for projects that are not specified.</td>
</tr>
<tr>
<td>.regex</td>
<td>The list of regular expressions that match project names.</td>
</tr>
<tr>
<td>pattern</td>
<td>The valid and properly escaped regular expression pattern enclosed by single quotation marks.</td>
</tr>
</tbody>
</table>

For example, to configure Curator to:

- Delete indices in the `myapp-dev` project older than **1 day**
- Delete indices in the `myapp-qe` project older than **1 week**
- Delete operations logs older than **8 weeks**
- Delete all other projects indices after they are **31 days** old
- Delete indices older than 1 day that are matched by the `^project\..+-dev.*$` regex
- Delete indices older than 2 days that are matched by the `^project\..+-test.*$` regex

Use:

```yaml
config.yaml: |
  .defaults:
    delete:
      days: 31
  .operations:
    delete:
      weeks: 8
  myapp-dev:
```
IMPORTANT

When you use **months** as the $UNIT for an operation, Curator starts counting at the first day of the current month, not the current day of the current month. For example, if today is April 15, and you want to delete indices that are 2 months older than today (delete: months: 2), Curator does not delete indices that are dated older than February 15; it deletes indices older than February 1. That is, it goes back to the first day of the current month, then goes back two whole months from that date. If you want to be exact with Curator, it is best to use days (for example, **delete: days: 30**).

8.6.3. Troubleshooting Curator

You can use information in this section for debugging Curator. For example, if curator is in failed state, but the log messages do not provide a reason, you could increase the log level and trigger a new job, instead of waiting for another scheduled run of the cron job.

**Prerequisites**

Cluster logging and Elasticsearch must be installed.

**Procedure**

Enable the Curator debug log and trigger next Curator iteration manually

1. Enable debug log of Curator:

   ```bash
   $ oc set env cronjob/curator CURATOR_LOG_LEVEL=DEBUG
   CURATOR_SCRIPT_LOG_LEVEL=DEBUG
   ```

   Specify the log level:

   - **CRITICAL**. Curator displays only critical messages.
   - **ERROR**. Curator displays only error and critical messages.
   - **WARNING**. Curator displays only error, warning, and critical messages.
   - **INFO**. Curator displays only informational, error, warning, and critical messages.
   - **DEBUG**. Curator displays only debug messages, in addition to all of the above.

   The default value is **INFO**.
NOTE

Cluster logging uses the OpenShift Container Platform custom environment variable CURATOR_SCRIPT_LOG_LEVEL in OpenShift Container Platform wrapper scripts (run.sh and convert.py). The environment variable takes the same values as CURATOR_LOG_LEVEL for script debugging, as needed.

1. Trigger next curator iteration:

   $ oc create job --from=cronjob/curator <job_name>

2. Use the following commands to control the CronJob:

   - Suspend a CronJob:
     
     $ oc patch cronjob curator -p '{"spec":{"suspend":true}}'

   - Resume a CronJob:
     
     $ oc patch cronjob curator -p '{"spec":{"suspend":false}}'

   - Change a CronJob schedule:
     
     $ oc patch cronjob curator -p '{"spec":{"schedule":"0 0 * * *"}}'

       1 The schedule option accepts schedules in cron format.

8.6.4. Configuring Curator in scripted deployments

Use the information in this section if you must configure Curator in scripted deployments.

Prerequisites

- Cluster logging and Elasticsearch must be installed.
- Set cluster logging to the unmanaged state.

Procedure

Use the following snippets to configure Curator in your scripts:

- For scripted deployments

  1. Create and modify the configuration:

     a. Copy the Curator configuration file and the OpenShift Container Platform custom configuration file from the Curator configuration map and create separate files for each:

        $ oc extract configmap/curator --keys=curator5.yaml,config.yaml --to=/my/config

     b. Edit the /my/config/curator5.yaml and /my/config/config.yaml files.
2. Delete the existing Curator config map and add the edited YAML files to a new Curator config map.

```bash
$ oc delete configmap curator ; sleep 1
$ oc create configmap curator \
   --from-file=curator5.yaml=/my/config/curator5.yaml \
   --from-file=config.yaml=/my/config/config.yaml \
   ; sleep 1
```

The next iteration will use this configuration.

- If you are using the action file:
  1. Create and modify the configuration:
     a. Copy the Curator configuration file and the action file from the Curator configuration map and create separate files for each:

        ```bash
        $ oc extract configmap/curator --keys=curator5.yaml,actions.yaml --to=/my/config
        ```

     b. Edit the `/my/config/curator5.yaml` and `/my/config/actions.yaml` files.

  2. Delete the existing Curator config map and add the edited YAML files to a new Curator config map.

        ```bash
        $ oc delete configmap curator ; sleep 1
        $ oc create configmap curator \
           --from-file=curator5.yaml=/my/config/curator5.yaml \
           --from-file=actions.yaml=/my/config/actions.yaml \
           ; sleep 1
        ```

The next iteration will use this configuration.

### 8.6.5. Using the Curator Action file

The Curator ConfigMap in the `openshift-logging` project includes a Curator action file where you configure any Curator action to be run periodically.

However, when you use the action file, OpenShift Container Platform ignores the `config.yaml` section of the curator ConfigMap, which is configured to ensure important internal indices do not get deleted by mistake. In order to use the action file, you should add an exclude rule to your configuration to retain these indices. You also must manually add all the other patterns following the steps in this topic.

**IMPORTANT**

The `actions` and `config.yaml` are mutually-exclusive configuration files. Once the actions file exist, OpenShift Container Platform ignores the `config.yaml` file. Using the action file is recommended only for advanced users as using this file can be destructive to the cluster and can cause removal of required indices/settings from Elasticsearch.

**Prerequisite**

- Cluster logging and Elasticsearch must be installed.
- Set cluster logging to the unmanaged state.
**Procedure**

To configure Curator to delete indices:

1. Edit the Curator ConfigMap:

   ```bash
   oc edit cm/curator -n openshift-logging
   ```

2. Make the following changes to the `action` file:

```yaml
actions:
  1:
    action: delete_indices
    description: 'Delete .operations indices older than 30 days. Ignore the error if the filter does not result in an actionable list of indices (ignore_empty_list).'
    options:
      # Swallow curator.exception.NoIndices exception
      ignore_empty_list: True
      # In seconds, default is 300
      timeout_override: ${CURATOR_TIMEOUT}
      # Don't swallow any other exceptions
      continue_if_exception: False
      # Optionally disable action, useful for debugging
      disable_action: False
      # All filters are bound by logical AND
      filters:
        2:
          - filtertype: pattern
            kind: regex
            value: '^\\.operations\..*$'
            exclude: False
          - filtertype: age
            source: name
            direction: older
            timestring: '%Y.%m.%d'
            unit: days
            unit_count: 30
            exclude: False
```

1. Specify `delete_indices` to delete the specified index.
2. Use the `filers` parameters to specify the index to be deleted. See the Elastic Search curator documentation for information on these parameters.
3. Specify `false` to allow the index to be deleted.

## 8.7. CONFIGURING THE LOGGING COLLECTOR

OpenShift Container Platform uses Fluentd to collect operations and application logs from your cluster and enriches the data with Kubernetes Pod and Namespace metadata.
You can configure log rotation, log location, use an external log aggregator, and make other configurations for the log collector.

**NOTE**

You must set cluster logging to Unmanaged state before performing these configurations, unless otherwise noted. For more information, see Changing the cluster logging management state.

### 8.7.1. Viewing logging collector pods

You can use the `oc get pods --all-namespaces -o wide` command to see the nodes where the Fluentd are deployed.

**Procedure**

Run the following command in the `openshift-logging` project:

```bash
$ oc get pods --all-namespaces -o wide | grep fluentd
```

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
<th>IP</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>fluentd-5mr28</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.129.2.12</td>
<td>ip-10-0-164-233.ec2.internal</td>
</tr>
<tr>
<td>fluentd-cnc4c</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.128.2.13</td>
<td>ip-10-0-155-142.ec2.internal</td>
</tr>
<tr>
<td>fluentd-nlp8z</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.131.0.13</td>
<td>ip-10-0-138-77.ec2.internal</td>
</tr>
<tr>
<td>fluentd-rknlk</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.128.0.33</td>
<td>ip-10-0-128-130.ec2.internal</td>
</tr>
<tr>
<td>fluentd-rsm49</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.129.0.37</td>
<td>ip-10-0-163-191.ec2.internal</td>
</tr>
<tr>
<td>fluentd-wjt8s</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>4m56s</td>
<td>10.130.0.42</td>
<td>ip-10-0-156-251.ec2.internal</td>
</tr>
</tbody>
</table>

### 8.7.2. Configure log collector CPU and memory limits

The log collector allows for adjustments to both the CPU and memory limits.

**Procedure**

1. Edit the Cluster Logging Custom Resource (CR) in the `openshift-logging` project:

```bash
$ oc edit ClusterLogging instance
$ oc edit ClusterLogging instance
```

```
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
```

...
Specify the CPU and memory limits and requests as needed. The values shown are the default values.

### 8.7.3. Configuring the collected log location

The log collector writes logs to a specified file or to the default location, `/var/log/fluentd/fluentd.log` based on the `LOGGING_FILE_PATH` environment variable.

**Prerequisite**

- Set cluster logging to the unmanaged state.

**Procedure**

To set the output location for the Fluentd logs:

1. Edit the `LOGGING_FILE_PATH` parameter in the `fluentd` daemonset. You can specify a particular file or `console`:

```yaml
spec:
  template:
    spec:
      containers:
        env:
          - name: LOGGING_FILE_PATH
            value: console
```

 Specify the log output method:

- use `console` to use the Fluentd default location. Retrieve the logs with the `oc logs [-f] <pod_name>` command.

- use `<path-to-log/fluentd.log>` to send the log output to the specified file. Retrieve the logs with the `oc exec <pod_name> -- logs` command. This is the default setting.

Or, use the CLI:

```
$ oc -n openshift-logging set env daemonset/fluentd LOGGING_FILE_PATH=/logs/fluentd.log
```

### 8.7.4. Throttling log collection
For projects that are especially verbose, an administrator can throttle down the rate at which the logs are read in by the log collector before being processed. By throttling, you deliberately slow down the rate at which you are reading logs, so Kibana might take longer to display records.

**WARNING**
Throttling can contribute to log aggregation falling behind for the configured projects; log entries can be lost if a pod is deleted before Fluentd catches up.

**NOTE**
Throttling does not work when using the systemd journal as the log source. The throttling implementation depends on being able to throttle the reading of the individual log files for each project. When reading from the journal, there is only a single log source, no log files, so no file-based throttling is available. There is not a method of restricting the log entries that are read into the Fluentd process.

**Prerequisite**
Set cluster logging to the unmanaged state.

**Procedure**

1. To configure Fluentd to restrict specific projects, edit the throttle configuration in the Fluentd ConfigMap after deployment:

   $ oc edit configmap/fluentd

   The format of the `throttle-config.yaml` key is a YAML file that contains project names and the desired rate at which logs are read in on each node. The default is 1000 lines at a time per node. For example:

   ```yaml
   throttle-config.yaml: |
   - opensift-logging:
     read_lines_limit: 10
   - .operations:
     read_lines_limit: 100
   ```

**8.7.5. Understanding Buffer Chunk Limiting for Fluentd**

If the Fluentd logger is unable to keep up with a high number of logs, it will need to switch to file buffering to reduce memory usage and prevent data loss.

Fluentd file buffering stores records in chunks. Chunks are stored in buffers.

The Fluentd `buffer_chunk_limit` is determined by the environment variable `BUFFER_SIZE_LIMIT`, which has the default value 8m. The file buffer size per output is determined by the environment variable `FILE_BUFFER_LIMIT`, which has the default value 256Mi. The permanent volume size must be larger than `FILE_BUFFER_LIMIT` multiplied by the output.
On the Fluentd pods, permanent volume `/var/lib/fluentd` should be prepared by the PVC or hostmount, for example. That area is then used for the file buffers.

The buffer_type and buffer_path are configured in the Fluentd configuration files as follows:

```bash
$ egrep "buffer_type|buffer_path" *.conf
output-es-config.conf:
  buffer_type file
  buffer_path `/var/lib/fluentd/buffer-output-es-config`
output-es-ops-config.conf:
  buffer_type file
  buffer_path `/var/lib/fluentd/buffer-output-es-ops-config`
```

The Fluentd buffer_queue_limit is the value of the variable BUFFER_QUEUE_LIMIT. This value is 32 by default.

The environment variable BUFFER_QUEUE_LIMIT is calculated as \((\text{FILE_BUFFER_LIMIT} / (\text{number_of_outputs} \times \text{BUFFER_SIZE_LIMIT}))\). If the BUFFER_QUEUE_LIMIT variable has the default set of values:

- \(\text{FILE_BUFFER_LIMIT} = 256\text{Mi}\)
- \(\text{number_of_outputs} = 1\)
- \(\text{BUFFER_SIZE_LIMIT} = 8\text{Mi}\)

The value of buffer_queue_limit will be 32. To change the buffer_queue_limit, you must change the value of FILE_BUFFER_LIMIT.

In this formula, number_of_outputs is 1 if all the logs are sent to a single resource, and it is incremented by 1 for each additional resource. For example, the value of number_of_outputs is:

- 1 - if all logs are sent to a single Elasticsearch pod
- 2 - if application logs are sent to an Elasticsearch pod and ops logs are sent to another Elasticsearch pod
- 4 - if application logs are sent to an Elasticsearch pod, ops logs are sent to another Elasticsearch pod, and both of them are forwarded to other Fluentd instances

### 8.7.6. Configuring log collection JSON parsing

You can configure the Fluentd log collector to determine if a log message is in JSON format and merge the message into the JSON payload document posted to Elasticsearch. This feature is disabled by default.

You can enable or disable this feature by editing the MERGE_JSON_LOG environment variable in the fluentd daemonset.
IMPORTANT

Enabling this feature comes with risks, including:

- Possible log loss due to Elasticsearch rejecting documents due to inconsistent type mappings.
- Potential buffer storage leak caused by rejected message cycling.
- Overwriting data for fields with the same name.

The features in this topic should be used by only experienced Fluentd and Elasticsearch users.

Prerequisites

Set cluster logging to the unmanaged state.

Procedure

Use the following command to enable this feature:

```
oc set env ds/fluentd MERGE_JSON_LOG=true
```

1. Set this to `false` to disable this feature or `true` to enable this feature.

Setting MERGE_JSON_LOG and CDM_UNDEFINED_TO_STRING

If you set the `MERGE_JSON_LOG` and `CDM_UNDEFINED_TO_STRING` envirorment variables to `true`, you might receive an Elasticsearch 400 error. The error occurs because when `MERGE_JSON_LOG=true`, Fluentd adds fields with data types other than `string`. When you set `CDM_UNDEFINED_TO_STRING=true`, Fluentd attempts to add those fields as a `string` value resulting in the Elasticsearch 400 error. The error clears when the indices roll over for the next day.

When Fluentd rolls over the indices for the next day’s logs, it will create a brand new index. The field definitions are updated and you will not get the 400 error.

Records that have hard errors, such as schema violations, corrupted data, and so forth, cannot be retried. The log collector sends the records for error handling. If you add a `<label @ERROR>` section to your Fluentd config, as the last `<label>`, you can handle these records as needed.

For example:

```yaml
data:
  fluent.conf:
    ...

  <label @ERROR>
    <match **>
      @type file
      path /var/log/fluent/dlq
      time_slice_format %Y%m%d
      time_slice_wait 10m
      time_format %Y%m%dT%H%M%S%z
```
This section writes error records to the Elasticsearch dead letter queue (DLQ) file. See the fluentd documentation for more information about the file output.

Then you can edit the file to clean up the records manually, edit the file to use with the Elasticsearch \_bulk index API and use cURL to add those records. For more information on Elasticsearch Bulk API, see the Elasticsearch documentation.

8.7.7. Configuring how the log collector normalizes logs

Cluster Logging uses a specific data model, like a database schema, to store log records and their metadata in the logging store. There are some restrictions on the data:

- There must be a "message" field containing the actual log message.
- There must be a "\@timestamp" field containing the log record timestamp in RFC 3339 format, preferably millisecond or better resolution.
- There must be a "level" field with the log level, such as `err`, `info`, `unknown`, and so forth.

NOTE

For more information on the data model, see Exported Fields.

Because of these requirements, conflicts and inconsistencies can arise with log data collected from different subsystems.

For example, if you use the `MERGE_JSON_LOG` feature (MERGE_JSON_LOG=true), it can be extremely useful to have your applications log their output in JSON, and have the log collector automatically parse and index the data in Elasticsearch. However, this leads to several problems, including:

- field names can be empty, or contain characters that are illegal in Elasticsearch;
- different applications in the same namespace might output the same field name with different value data types;
- applications might emit too many fields;
- fields may conflict with the cluster logging built-in fields.

You can configure how cluster logging treats fields from disparate sources by editing the Fluentd log collector daemonset and setting environment variables in the table below.

- Undefined fields. One of the problems with log data from disparate systems is that some fields might be unknown to the ViaQ data model. Such fields are called `undefined`. ViaQ requires all top-level fields to be defined and described.
  Use the parameters to configure how OpenShift Container Platform moves any undefined fields under a top-level field called `undefined` to avoid conflicting with the well known ViaQ top-level fields. You can add undefined fields to the top-level fields and move others to an `undefined` container.
You can also replace special characters in undefined fields and convert undefined fields to their JSON string representation. Converting to JSON string preserves the structure of the value, so that you can retrieve the value later and convert it back to a map or an array.

- Simple scalar values like numbers and booleans are changed to a quoted string. For example: 10 becomes "10", 3.1415 becomes "3.1415", false becomes "false".
- Map/dict values and array values are converted to their JSON string representation: "mapfield":{"key":"value"} becomes "mapfield":{"key":"value"}" and "arrayfield": [1,2,"three"] becomes "arrayfield":[1,2,"three"].
- Defined fields. You can also configure which defined fields appear in the top levels of the logs. The default top-level fields, defined through the CDM_DEFAULT_KEEP_FIELDS parameter, are CEE, time, @timestamp, aushape, ci_job, collectd, docker, fedora-ci, file, foreman, geop, hostname, ipaddr4, ipaddr6, kubernetes, level, message, namespace_name, namespace_uuid, offset, openstack, ovirt, pid, pipeline_metadata, service, systemd, tags, testcase, tlog, viaq_msg_id, viaq_index_name.

Any fields not included in $(CDM_DEFAULT_KEEP_FIELDS) or $(CDM_EXTRA_KEEP_FIELDS) are moved to $(CDM_UNDEFINED_NAME) if CDM_USE_UNDEFINED is true.

**NOTE**
The CDM_DEFAULT_KEEP_FIELDS parameter is for only advanced users, or if you are instructed to do so by Red Hat support.

- Empty fields. You can determine which empty fields to retain from disparate logs.

**Table 8.3. Environment variables for log normalization**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDM_EXTRA_KEEP_FIELDS</td>
<td>Specify an extra set of defined fields to be kept at the top level of the logs in addition to the CDM_DEFAULT_KEEP_FIELDS. The default is &quot;&quot;.</td>
<td>CDM_EXTRA_KEEP_FIELDS=&quot;broker&quot;</td>
</tr>
<tr>
<td>CDM_KEEP_EMPTY_FIELDS</td>
<td>Specify fields to retain even if empty in CSV format. Empty defined fields not specified are dropped. The default is &quot;message&quot;, keep empty messages.</td>
<td>CDM_KEEP_EMPTY_FIELDS=&quot;message&quot;</td>
</tr>
<tr>
<td>CDM_USE_UNDEFINED</td>
<td>Set to true to move undefined fields to the undefined top level field. The default is false. If true, values in CDM_DEFAULT_KEEP_FIELDS and CDM_EXTRA_KEEP_FIELDS are not moved to undefined.</td>
<td>CDM_USE_UNDEFINED=true</td>
</tr>
<tr>
<td>CDM_UNDEFINED_NAME</td>
<td>Specify a name for the undefined top level field if using CDM_USE_UNDEFINED. The default is undefined. Enabled only when CDM_USE_UNDEFINED is true.</td>
<td>CDM_UNDEFINED_NAME=&quot;undef&quot;</td>
</tr>
</tbody>
</table>
If the number of undefined fields is greater than this number, all undefined fields are converted to their JSON string representation and stored in the CDM_UNDEFINED_NAME field. If the record contains more than this value of undefined fields, no further processing takes place on these fields. Instead, the fields will be converted to a single string JSON value, stored in the top-level CDM_UNDEFINED_NAME field. Keeping the default of -1 allows for an unlimited number of undefined fields, which is not recommended.

**NOTE:** This parameter is honored even if CDM_USE_UNDEFINED is false.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDM_UNDEFINED_MAX_NUM_FIELDS</td>
<td>If the number of undefined fields is greater than this number, all undefined fields are converted to their JSON string representation and stored in the CDM_UNDEFINED_NAME field. If the record contains more than this value of undefined fields, no further processing takes place on these fields. Instead, the fields will be converted to a single string JSON value, stored in the top-level CDM_UNDEFINED_NAME field. Keeping the default of -1 allows for an unlimited number of undefined fields, which is not recommended.</td>
<td>CDM_UNDEFINED_MAX_NUM_FIELDS=4</td>
</tr>
<tr>
<td>CDM_UNDEFINED_TO_STRING</td>
<td>Set to true to convert all undefined fields to their JSON string representation. The default is false.</td>
<td>CDM_UNDEFINED_TO_STRING=true</td>
</tr>
<tr>
<td>CDM_UNDEFINED_DOT_REPLACE_CHAR</td>
<td>Specify a character to use in place of a dot character ( . ) in an undefined field. MERGE_JSON_LOG must be true. The default is UNUSED. If you set the MERGE_JSON_LOG parameter to true, see the Note below.</td>
<td>CDM_UNDEFINED_DOT_REPLACE_CHAR=&quot;-&quot;</td>
</tr>
</tbody>
</table>

**NOTE**

If you set the MERGE_JSON_LOG parameter in the Fluentd log collector daemonset and CDM_UNDEFINED_TO_STRING environment variables to true, you might receive an Elasticsearch 400 error. The error occurs because when MERGE_JSON_LOG=true, the log collector adds fields with data types other than string. When you set CDM_UNDEFINED_TO_STRING=true, the log collector attempts to add those fields as a string value resulting in the Elasticsearch 400 error. The error clears when the log collector rolls over the indices for the next day’s logs.

When the log collector rolls over the indices, it creates a brand new index. The field definitions are updated and you will not get the 400 error.

**Procedure**

Use the CDM_* parameters to configure undefined and empty field processing.

1. Configure how to process fields, as needed:
   a. Specify the fields to move using CDM_EXTRA_KEEP_FIELDS.
   b. Specify any empty fields to retain in the CDM_KEEP_EMPTY_FIELDS parameter in CSV format.

2. Configure how to process undefined fields, as needed:
   a. Set CDM_USE_UNDEFINED to true to move undefined fields to the top-level undefined field.

---

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field:

b. Specify a name for the undefined fields using the `CDM_UNDEFINED_NAME` parameter.

c. Set `CDM_UNDEFINED_MAX_NUM_FIELDS` to a value other than the default `-1`, to set an upper bound on the number of undefined fields in a single record.

3. Specify `CDM_UNDEFINED_DOT_REPLACE_CHAR` to change any dot `.` characters in an undefined field name to another character. For example, if `CDM_UNDEFINED_DOT_REPLACE_CHAR=@@@` and there is a field named `foo.bar.baz` the field is transformed into `foo@@@bar@@@baz`.

4. Set `UNDEFINED_TO_STRING` to `true` to convert undefined fields to their JSON string representation.

NOTE

If you configure the `CDM_UNDEFINED_TO_STRING` or `CDM_UNDEFINED_MAX_NUM_FIELDS` parameters, you use the `CDM_UNDEFINED_NAME` to change the undefined field name. This field is needed because `CDM_UNDEFINED_TO_STRING` or `CDM_UNDEFINED_MAX_NUM_FIELDS` could change the value type of the undefined field. When `CDM_UNDEFINED_TO_STRING` or `CDM_UNDEFINED_MAX_NUM_FIELDS` is set to `true` and there are more undefined fields in a log, the value type becomes `string`. Elasticsearch stops accepting records if the value type is changed, for example, from JSON to JSON string.

For example, when `CDM_UNDEFINED_TO_STRING` is `false` or `CDM_UNDEFINED_MAX_NUM_FIELDS` is the default, `-1`, the value type of the undefined field is `json`. If you change `CDM_UNDEFINED_MAX_NUM_FIELDS` to a value other than default and there are more undefined fields in a log, the value type becomes `string` (json string). Elasticsearch stops accepting records if the value type is changed.

8.7.8. Configuring the logging collector using environment variables

You can use environment variables to modify the configuration of the Fluentd log collector.

See the Fluentd README in Github for lists of the available environment variables.

Prerequisite

Set cluster logging to the unmanaged state.

Procedure

Set any of the Fluentd environment variables as needed:

```
  oc set env ds/fluentd <env-var>=<value>
```

For example:

```
  oc set env ds/fluentd LOGGING_FILE_AGE=30
```

8.7.9. About logging collector alerts
The following alerts are generated by the logging collector and can be viewed on the Alerts tab of the Prometheus UI.

All the logging collector alerts are listed on the Monitoring → Alerts page of the OpenShift Container Platform web console. Alerts are in one of the following states:

- **Firing.** The alert condition is true for the duration of the timeout. Click the Options menu at the end of the firing alert to view more information or silence the alert.
- **Pending** The alert condition is currently true, but the timeout has not been reached.
- **Not Firing.** The alert is not currently triggered.

### Table 8.4. Fluentd Prometheus alerts

<table>
<thead>
<tr>
<th>Alert</th>
<th>Message</th>
<th>Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>FluentdErrorsHigh</td>
<td>In the last minute, &lt;value&gt; errors reported by fluentd &lt;instance&gt;.</td>
<td>Fluentd is reporting a higher number of issues than the specified number, default 10.</td>
<td>Critical</td>
</tr>
<tr>
<td>FluentdNodeDown</td>
<td>Prometheus could not scrape fluentd &lt;instance&gt; for more than 10m.</td>
<td>Fluentd is reporting that Prometheus could not scrape a specific Fluentd instance.</td>
<td>Critical</td>
</tr>
<tr>
<td>FluentdQueueLength</td>
<td>In the last minute, fluentd &lt;instance&gt; buffer queue length increased more than 32. Current value is &lt;value&gt;.</td>
<td>Fluentd is reporting that it is overwhelmed.</td>
<td>Warning</td>
</tr>
<tr>
<td>FluentdQueueLength</td>
<td>In the last 12h, fluentd &lt;instance&gt; buffer queue length constantly increased more than 1. Current value is &lt;value&gt;.</td>
<td>Fluentd is reporting queue usage issues.</td>
<td>Critical</td>
</tr>
</tbody>
</table>

### 8.8. USING TOLERATIONS TO CONTROL CLUSTER LOGGING POD PLACEMENT

You can use taints and tolerations to ensure that cluster logging pods run on specific nodes and that no other workload can run on those nodes.

Taints and tolerations are simple key:value pair. A taint on a node instructs the node to repel all Pods that do not tolerate the taint.

The key is any string, up to 253 characters and the value is any string up to 63 characters. The string must begin with a letter or number, and may contain letters, numbers, hyphens, dots, and underscores.

Sample cluster logging CR with tolerations
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: openshift-logging
spec:
  managementState: "Managed"
logStore:
  type: "elasticsearch"
  elasticsearch:
    nodeCount: 1
    tolerations:
      - key: "logging"
        operator: "Exists"
        effect: "NoExecute"
        tolerationSeconds: 6000
    resources:
      limits:
        memory: 8Gi
      requests:
        cpu: 100m
        memory: 1Gi
  storage: {}
  redundancyPolicy: "ZeroRedundancy"
visualization:
  type: "kibana"
  kibana:
    tolerations:
      - key: "logging"
        operator: "Exists"
        effect: "NoExecute"
        tolerationSeconds: 6000
    resources:
      limits:
        memory: 2Gi
      requests:
        cpu: 100m
        memory: 1Gi
  replicas: 1

curation:
  type: "curator"
  curator:
    tolerations:
      - key: "logging"
        operator: "Exists"
        effect: "NoExecute"
        tolerationSeconds: 6000
    resources:
      limits:
        memory: 200Mi
      requests:
        cpu: 100m
        memory: 100Mi
    schedule: "*/5 * * * *"
logs:
  type: "fluentd"
  fluentd:
    tolerations:
      - key: "logging"
        operator: "Exists"
        effect: "NoExecute"
        tolerationSeconds: 6000
  resources:
    limits:
      memory: 2Gi
    requests:
      cpu: 100m
      memory: 1Gi

This toleration is added to the Elasticsearch pods.

This toleration is added to the Kibana pod.

This toleration is added to the Curator pod.

This toleration is added to the logging collector pods.

8.8.1. Using tolerations to control the Elasticsearch Pod placement

You can control which nodes the Elasticsearch Pods runs on and prevent other workloads from using those nodes by using tolerations on the Pods.

You apply tolerations to Elasticsearch Pods through the Cluster Logging Custom Resource (CR) and apply taints to a node through the node specification. A taint on a node is a key:value pair that instructs the node to repel all Pods that do not tolerate the taint. Using a specific key:value pair that is not on other Pods ensures only Elasticsearch Pods can run on that node.

By default, the Elasticsearch Pods have the following toleration:

tolerations:
  - effect: "NoExecute"
    key: "node.kubernetes.io/disk-pressure"
    operator: "Exists"

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Use the following command to add a taint to a node where you want to schedule the cluster logging Pods:

   $ oc adm taint nodes <node-name> <key>=<value>:<effect>

   For example:
This example places a taint on node1 that has key `elasticsearch`, value `node`, and taint effect `NoExecute`. Nodes with the `NoExecute` effect schedule only Pods that match the taint and remove existing Pods that do not match.

2. Edit the `logstore` section of the Cluster Logging Custom Resource (CR) to configure a toleration for the Elasticsearch Pods:

   ```yaml
   logStore:
     type: "elasticsearch"
     elasticsearch:
       nodeCount: 1
       tolerations:
         - key: "elasticsearch"
           operator: "Exists"
           effect: "NoExecute"
           tolerationSeconds: 6000
   ```

   1. Specify the key that you added to the node.
   2. Specify the `Exists` operator to require a taint with the key `elasticsearch` to be present on the Node.
   3. Specify the `NoExecute` effect.
   4. Optionally, specify the `tolerationSeconds` parameter to set how long a Pod can remain bound to a node before being evicted.

   This toleration matches the taint created by the `oc adm taint` command. A Pod with this toleration could be scheduled onto node1.

### 8.8.2. Using tolerations to control the Kibana Pod placement

You can control which nodes the Kibana Pods run on and prevent other workloads from using those nodes by using tolerations on the Pods.

You apply tolerations to the Kibana Pods through the Cluster Logging Custom Resource (CR) and apply taints to a node through the node specification. A taint on a node is a `key:value pair` that instructs the node to repel all Pods that do not tolerate the taint. Using a specific `key:value` pair that is not on other Pods ensures only the Kibana Pod can run on that node.

**Prerequisites**

- Cluster logging and Elasticsearch must be installed.

**Procedure**

1. Use the following command to add a taint to a node where you want to schedule the Kibana Pod:

   ```bash
   $ oc adm taint nodes <node-name> <key>=<value>:<effect>
   ```

   For example:
$ oc adm taint nodes node1 kibana=node:NoExecute

This example places a taint on node1 that has key kibana, value node, and taint effect NoExecute. You must use the NoExecute taint effect. NoExecute schedules only Pods that match the taint and remove existing Pods that do not match.

2. Edit the visualization section of the Cluster Logging Custom Resource (CR) to configure a toleration for the Kibana Pod:

   visualization:
     type: "kibana"
     kibana:
       tolerations:
       - key: "kibana"  
         operator: "Exists"  
         effect: "NoExecute"  
         tolerationSeconds: 6000

   1 Specify the key that you added to the node.
   2 Specify the Exists operator to require the key/value/effect parameters to match.
   3 Specify the NoExecute effect.
   4 Optionally, specify the tolerationSeconds parameter to set how long a Pod can remain bound to a node before being evicted.

This toleration matches the taint created by the oc adm taint command. A Pod with this toleration would be able to schedule onto node1.

8.8.3. Using tolerations to control the Curator Pod placement

You can control which node the Curator Pod runs on and prevent other workloads from using those nodes by using tolerations on the Pod.

You apply tolerations to the Curator Pod through the Cluster Logging Custom Resource (CR) and apply taints to a node through the node specification. A taint on a node is a key:value pair that instructs the node to repel all Pods that do not tolerate the taint. Using a specific key:value pair that is not on other Pods ensures only the Curator Pod can run on that node.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Use the following command to add a taint to a node where you want to schedule the Curator Pod:

   $ oc adm taint nodes <node-name> <key>=<value>:<effect>

   For example:
$ oc adm taint nodes node1 curator=node:NoExecute

This example places a taint on node1 that has key curator, value node, and taint effect NoExecute. You must use the NoExecute taint effect. NoExecute schedules only Pods that match the taint and remove existing Pods that do not match.

2. Edit the curation section of the Cluster Logging Custom Resource (CR) to configure a toleration for the Curator Pod:

```yaml
curation:
  type: "curator"
  curator:
    tolerations:
      - key: "curator"  # 1
        operator: "Exists"  # 2
        effect: "NoExecute"  # 3
        tolerationSeconds: 6000  # 4
```

1. Specify the key that you added to the node.
2. Specify the Exists operator to require the key/value/effect parameters to match.
3. Specify the NoExecute effect.
4. Optionally, specify the tolerationSeconds parameter to set how long a Pod can remain bound to a node before being evicted.

This toleration matches the taint that is created by the `oc adm taint` command. A Pod with this toleration would be able to schedule onto node1.

### 8.8.4. Using tolerations to control the log collector Pod placement

You can ensure which nodes the logging collector Pods run on and prevent other workloads from using those nodes by using tolerations on the Pods.

You apply tolerations to logging collector Pods through the Cluster Logging Custom Resource (CR) and apply taints to a node through the node specification. You can use taints and tolerations to ensure the Pod does not get evicted for things like memory and CPU issues.

By default, the logging collector Pods have the following toleration:

```
tolerations:
  - key: "node-role.kubernetes.io/master"
    operator: "Exists"
    effect: "NoExecute"
```

**Prerequisites**

- Cluster logging and Elasticsearch must be installed.

**Procedure**
1. Use the following command to add a taint to a node where you want logging collector Pods to schedule logging collector Pods:

```
$ oc adm taint nodes <node-name> <key>=<value>:<effect>
```

For example:

```
$ oc adm taint nodes node1 collector=node:NoExecute
```

This example places a taint on `node1` that has key `collector`, value `node`, and taint effect `NoExecute`. You must use the `NoExecute` taint effect. `NoExecute` schedules only Pods that match the taint and removes existing Pods that do not match.

2. Edit the `collection` section of the Cluster Logging Custom Resource (CR) to configure a toleration for the logging collector Pods:

```
collection:
  logs:
    type: "fluentd"
  rsyslog:
    tolerations:
      - key: "collector"
        operator: "Exists"
        effect: "NoExecute"
        tolerationSeconds: 6000
```

1. Specify the key that you added to the node.
2. Specify the `Exists` operator to require the `key/value/effect` parameters to match.
3. Specify the `NoExecute` effect.
4. Optionally, specify the `tolerationSeconds` parameter to set how long a Pod can remain bound to a node before being evicted.

This toleration matches the taint created by the `oc adm taint` command. A Pod with this toleration would be able to schedule onto `node1`.

### 8.8.5. Additional resources

For more information about taints and tolerations, see [Controlling pod placement using node taints](#).

### 8.9. FORWARDING CLUSTER LOGS TO SPECIFIC ENDPOINTS

The cluster logging Log Forwarding feature enables administrators to configure custom pipelines to send your container and node logs to specific endpoints within or outside of your cluster. You can send logs by type to the internal OpenShift Container Platform Elasticsearch instance and/or remote destinations not managed by OpenShift Container Platform cluster logging, such as your existing logging service, an external Elasticsearch cluster, external log aggregation solutions, or a Security Information and Event Management (SIEM) system.
**IMPORTANT**

Log Forwarding is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information about the support scope of Red Hat Technology Preview features, see [https://access.redhat.com/support/offerings/techpreview/](https://access.redhat.com/support/offerings/techpreview/).

Log Forwarding provides an easier way to forward logs to specific endpoints inside or outside your OpenShift Container Platform cluster than using the Fluentd plugins.

**NOTE**

The Log Forwarding feature is optional. If you do not want to forward logs and use only the internal OpenShift Container Platform Elasticsearch instance, do not configure the Log Forwarding feature.

You can send different types of logs to different systems allowing you to control who in your organization can access each type. Optional TLS support ensures that you can send logs using secure communication as required by your organization.

### 8.9.1. Understanding cluster log forwarding

The OpenShift Container Platform cluster log forwarding feature uses a combination of outputs and pipelines defined in the Log Forwarding Custom Resource to send logs to specific endpoints inside and outside of your OpenShift Container Platform cluster.

**NOTE**

If you want to use only the default internal OpenShift Container Platform Elasticsearch instance, do not configure any outputs and pipelines.

An output is the destination for log data and a pipeline defines simple routing for one source to one or more outputs.

An output can be either:

- **elasticsearch** to forward logs to an external Elasticsearch v5.x cluster, specified by server name or FQDN, and/or the internal OpenShift Container Platform Elasticsearch instance.
- **forward** to forward logs to an external log aggregation solution. This option uses the Fluentd forward plug-ins.

A pipeline associates the type of data to an output. A type of data you can forward is one of the following:

- **logs.app** - Container logs generated by user applications running in the cluster, except infrastructure container applications.
- **logs.infra** - Logs generated by both infrastructure components running in the cluster and OpenShift Container Platform nodes, such as journal logs. Infrastructure components are pods that run in the `openshift*`, `kube*`, or `default` projects.

- **logs.audit** - Logs generated by the node audit system (auditd), which are stored in the `/var/log/audit/audit.log` file, and the audit logs from the Kubernetes apiserver and the OpenShift apiserver.

Note the following:

- The internal OpenShift Container Platform Elasticsearch instance does not provide secure storage for audit logs. We recommend you ensure that the system to which you forward audit logs is compliant with your organizational and governmental regulations and is properly secured. OpenShift Container Platform cluster logging does not comply with those regulations.

- An output supports TLS communication using a secret. Secrets must have keys of: `tls.crt`, `tls.key`, and `ca-bundler.crt` which point to the respective certificates for which they represent. Secrets must have the key `shared_key` for use when using forward in a secure manner.

- You are responsible to create and maintain any additional configurations that external destinations might require, such as keys and secrets, service accounts, port opening, or global proxy configuration.

The following example creates three outputs:

- the internal OpenShift Container Platform Elasticsearch instance,

- an unsecured externally-managed Elasticsearch instance,

- a secured external log aggregator using the `forward` plug-in.

Three pipelines send:

- the application logs to the internal OpenShift Container Platform Elasticsearch,

- the infrastructure logs to an external Elasticsearch instance,

- the audit logs to the secured device over the `forward` plug-in.

Sample log forwarding outputs and pipelines

```yaml
apiVersion: "logging.openshift.io/v1alpha1"
kind: "LogForwarding"
metadata:
  name: instance
  namespace: openshift-logging
spec:
  disableDefaultForwarding: true
  outputs:
  - type: "elasticsearch"
    name: elasticsearch
    endpoint: elasticsearch.openshift-logging.svc:9200
    secret:
      name: fluentd
    - type: "elasticsearch"
      name: elasticsearch-insecure
```
The name of the log forwarding CR must be **instance**.

Set to **enabled** to enable log forwarding.

Configuration for the outputs.

The type of output, either **elasticsearch** or **forward**.

A name to describe the output.

The log forwarding endpoint, either the server name or FQDN. For the internal OpenShift Container Platform Elasticsearch instance, specify `elasticsearch.openshift-logging.svc:9200`.

Optional name of the secret required by the endpoint for TLS communication. The secret must exist in the `openshift-logging` project.

Optional setting if the endpoint does not use a secret, resulting in insecure communication.

Configuration for the pipelines.

A name to describe the pipeline.

The source type, `logs.app`, `logs.infra`, or `logs.audit`.

The name of one or more outputs configured in the CR.

---

8.9.2. Configuring the Log Forwarding feature

To configure the Log Forwarding, edit the Cluster Logging Custom Resource (CR) to add the `clusterlogging.openshift.io/logforwardingtechpreview: enabled` annotation and create a Log Forwarding Custom Resource to specify the outputs, pipelines, and enable log forwarding.

If you enable Log Forwarding, you should define a pipeline all for three source types: `logs.app`, `logs.infra`, and `logs.audit`.
logs.infra, and logs.audit. The logs from any undefined source type are dropped. For example, if you specified a pipeline for the logs.app and log-audit types, but did not specify a pipeline for the logs.infra type, logs.infra logs are dropped.

Procedure

To configure the Log Forwarding feature:

1. Edit the Cluster Logging Custom Resource (CR) in the openshift-logging project:

   ```
   $ oc edit ClusterLogging instance
   ```

2. Add the clusterlogging.openshift.io/logforwardingtechpreview annotation and set to enabled:

   ```json
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     annotations:
       clusterlogging.openshift.io/logforwardingtechpreview: enabled
   name: "instance"
   namespace: "openshift-logging"
   spec:
     collection:
       logs:
         type: "fluentd"
         fluentd: {}
   ```

   1 Enables and disables the Log Forwarding feature. Set to enabled to use log forwarding. To use the only the OpenShift Container Platform Elasticsearch instance, set to disabled or do not add the annotation.

   2 The spec.collection block must be defined in the Cluster Logging CR for log forwarding to work.

3. Create the Log Forwarding Custom Resource:

   ```json
   apiVersion: "logging.openshift.io/v1alpha1"
   kind: "LogForwarding"
   metadata:
     name: instance
     namespace: openshift-logging
   spec:
     disableDefaultForwarding: true
     outputs:
       - type: "elasticsearch"
         name: elasticsearch
         endpoint: elasticsearch.openshift-logging.svc:9200
         secret:
           name: elasticsearch
       - type: "elasticsearch"
   ```
The name of the log forwarding CR must be **instance**.

The namespace for the log forwarding CR must be **openshift-logging**.

Set to **enabled** to enable log forwarding.

Add one or more endpoints:

- Specify the type of output, either **elasticsearch** or **forward**.
- Enter a name for the output.
- Enter the endpoint, either the server name or FQDN.
- Optionally, enter the name of the secret required by the endpoint for TLS communication. The secret must exist in the openshift-logging project.
- Specify **insecure: true** if the endpoint does not use a secret, resulting in insecure communication.

Add one or more pipelines:

- Enter a name for the pipeline
- Specify the source type: **logs.app**, **logs.infra**, or **logs.audit**.
- Specify the name of one or more outputs configured in the CR.
NOTE

If you set `disableDefaultForwarding: true` you must configure a pipeline and output for all three types of logs, application, infrastructure, and audit. If you do not specify a pipeline and output for a log type, those logs are not stored and will be lost.

8.9.2.1. Example log forwarding custom resources

A typical Log Forwarding configuration would be similar to the following examples.

The following Log Forwarding custom resource sends all logs to a secured external Elasticsearch instance:

Sample custom resource to forward to an Elasticsearch instance

```yaml
apiVersion: logging.openshift.io/v1alpha1
kind: LogForwarding
metadata:
  name: instance
  namespace: openshift-logging
spec:
  disableDefaultForwarding: true
  outputs:
  - name: user-created-es
    type: elasticsearch
    endpoint: 'elasticsearch-server.openshift-logging.svc:9200'
    secret:
      name: pipelinesecret
    pipelines:
      - name: app-pipeline
        inputSource: logs.app
        outputRefs:
          - user-created-es
      - name: infra-pipeline
        inputSource: logs.infra
        outputRefs:
          - user-created-es
      - name: audit-pipeline
        inputSource: logs.audit
        outputRefs:
          - user-created-es
```

The following Log Forwarding custom resource sends all logs to a secured Fluentd instance using the Fluentd `out_forward` plug-in.

Sample custom resource to use the `out_forward` plugin

```yaml
apiVersion: logging.openshift.io/v1alpha1
kind: LogForwarding
metadata:
  name: instance
  namespace: openshift-logging
spec:
  disableDefaultForwarding: true
  outputs:
```
The following Log Forwarding custom resource sends all logs to the internal OpenShift Container Platform Elasticsearch instance, which is the default log forwarding method.

Sample custom resource to use the default log forwarding

```yaml
apiVersion: logging.openshift.io/v1alpha1
kind: LogForwarding
metadata:
  name: instance
  namespace: openshift-logging
spec:
  disableDefaultForwarding: false
```

8.9.3. Additional resources

Alternatively, you can use Fluentd plugins to forward logs. For more information, see Sending logs to external devices using Fluentd plugins.

8.10. SENDING LOGS TO EXTERNAL DEVICES USING FLUENTD FORWARD PLUG-INS

OpenShift Container Platform cluster logging allows you to configure the Fluentd `out_forward` plug-in to send logs to external devices.

You can use the log forwarding feature, which can be easier to configure than the plugins. Note that the log forwarding feature is currently in Technology Preview.
IMPORTANT

Changes introduced by the new log forward feature modified the support for **out_forward** starting with the OpenShift Container Platform 4.3 release. In OpenShift Container Platform 4.3, you create a ConfigMap to configure **out_forward**, as described below, instead of editing the **secure-forward.conf** section in the **fluentd** ConfigMap. You can add any certificates required by your external devices to a secret, called **secure-forward**, which is mounted to the Fluentd Pods.

When you update to OpenShift Container Platform 4.3, any existing modifications to the **secure-forward.conf** section of the **fluentd** ConfigMap are removed. You can copy your current **secure-forward.conf** section before updating to use when creating the **secure-forward** ConfigMap.

8.10.1. Configuring the Fluentd out_forward plug-in to send logs to an external log aggregator

You can configure Fluentd to send a copy of its logs to an external log aggregator instead of the default Elasticsearch instance using the Fluentd **forward** plug-in. From there, you can further process log records after the locally hosted Fluentd has processed them.

**NOTE**

You can configure OpenShift Container Platform to send logs to both the internal Elasticsearch instance and an outside log aggregator using the '@type copy' plug-in within the Fluentd **output-application** configuration file. Specific instructions for this configuration are beyond the scope of this documentation.

In this documentation, the OpenShift Container Platform cluster is called the **sender** and the external aggregator is called the **receiver**.

**NOTE**

This legacy **out_forward** method is deprecated and will be removed in a future release.

The **forward** plug-ins are supported by Fluentd only. The **out_forward** plug-in implements the client side (sender) and the **in_forward** plug-in implements the server side (receiver).

To configure OpenShift Container Platform to send logs using **out_forward**, create a ConfigMap called **secure-forward** in the **openshift-logging** namespace that points to a receiver. On the receiver, configure the **in_forward** plug-in to receive the logs from OpenShift Container Platform. For more information on using the **in_forward** plug-in, see the Fluentd documentation.
IMPORTANT

Changes introduced by the new log forward feature modified the support for **out_forward** starting with the OpenShift Container Platform 4.3 release. In OpenShift Container Platform 4.3, you create a ConfigMap, as described below, to configure out_forward. Any updates to the **secure-forward.conf** section of the Fluentd ConfigMap are removed. Before upgrading cluster logging, you can copy your current **secure-forward.conf** section and use the copied data when you create the **secure-forward** ConfigMap.

Additionally, you can add any certificates required by your configuration to a secret named **secure-forward** that will be mounted to the Fluentd Pods.

Sample secure-forward.conf

```xml
<store>
  @type forward
  <security>
    self_hostname $\{hostname\} # $\{hostname\} is a placeholder.
    shared_key "fluent-receiver"
  </security>
  transport tls
  tls_verify_hostname false       # Set false to ignore server cert hostname.
  tls_cert_path '/etc/ocp-forward/ca-bundle.crt'
  <buffer>
    @type file
    path '/var/lib/fluentd/secureforwardlegacy'
    queued_chunks_limit_size "#{ENV['BUFFER_QUEUE_LIMIT'] || '1024' }"
    chunk_limit_size "#{ENV['BUFFER_SIZE_LIMIT'] || '1m' }"
    flush_interval "#{ENV['FORWARD_FLUSH_INTERVAL'] || '5s' }"
    flush_at_shutdown "#{ENV['FLUSH_AT_SHUTDOWN'] || 'false' }"
    flush_thread_count "#{ENV['FORWARD_FLUSH_THREAD_COUNT'] || '2' }"
    retry_max_interval "#{ENV['FORWARD_RETRY_WAIT'] || '300' }"
    retry_forever true
    # the systemd journald 0.0.8 input plugin will just throw away records if the buffer
    # queue limit is hit - 'block' will halt further reads and keep retrying to flush the
    # buffer to the remote - default is 'exception' because in_tail handles that case
    overflow_action "#{ENV['BUFFER_QUEUE_FULL_ACTION'] || 'exception' }"
  </buffer>
  <server>
    host fluent-receiver.openshift-logging.svc  # or IP
    port 24224
  </server>
</store>
```

Sample secure-forward ConfigMap based on the configuration

```yaml
apiVersion: v1
data:
secure-forward.conf: "<store>
  @type forward
  <security>
    self_hostname $\{hostname\} # $\{hostname\} is a placeholder.
    shared_key "fluent-receiver"
</store>
```
Procedure

To configure the `out_forward` plug-in:

1. Create a configuration file named `secure-forward.conf` for the `out_forward` parameters:

   a. Configure the secrets and TLS information:

   ```xml
   <store>
   @type forward
   self_hostname ${hostname}  
   shared_key <SECRET_STRING>  
   transport tls
   tls_verify_hostname true
   tls_cert_path <path_to_file>
   </store>
   ```

   1. Specify the default value of the auto-generated certificate common name (CN).
   2. Enter the Shared key between nodes.

2. Create a configuration file named `secure-forward.conf` for the `out_forward` parameters:

   a. Configure the secrets and TLS information:

   ```xml
   <store>
   @type forward
   self_hostname ${hostname}
   shared_key <SECRET_STRING>
   transport tls
   tls_verify_hostname true
   tls_cert_path <path_to_file>
   </store>
   ```

   1. Specify the default value of the auto-generated certificate common name (CN).
   2. Enter the Shared key between nodes.
3 Specify **tls** to enable TLS validation.

4 Set to **true** to verify the server cert hostname. Set to **false** to ignore server cert hostname.

5 Specify the path to private CA certificate file as **/etc/ocp-forward/ca_cert.pem**.

To use mTLS, see the [Fluentd documentation](https://fluentd.org) for information about client certificate, key parameters, and other settings.

b. Configure the name, host, and port for your external Fluentd server:

```xml
<server>
  name 1
  host 2
  hostlabel 3
  port 4
</server>
<server> 5
  name
  host
</server>
```

1 Optionally, enter a name for this receiver.

2 Specify the host name or IP of the receiver.

3 Specify the host label of the receiver.

4 Specify the port of the receiver.

5 Optionally, add additional receivers. If you specify two or more receivers, **out_secure_forward** uses these server nodes in a round-robin order.

For example:

```xml
<server>
  name externalserver1
  host 192.168.1.1
  hostlabel externalserver1.example.com
  port 24224
</server>
<server>
  name externalserver2
  host externalserver2.example.com
  port 24224
</server>
</store>
```

2. Create a ConfigMap named **secure-forward** in the **openshift-logging** namespace from the configuration file:

```
$ oc create configmap secure-forward --from-file=secure-forward.conf -n openshift-logging
```
3. Optionally, import any secrets required for the receiver:

```
$ oc create secret generic secure-forward --from-file=<arbitrary-name-of-key1>=cert_file_from_fluentd_receiver --from-literal=shared_key=value_from_fluentd_receiver
```

For example:

```
$ oc create secret generic secure-forward --from-file=ca-bundle.crt=ca-for-fluentd-receiver/ca.crt --from-literal=shared_key=fluentd-receiver
```

4. Refresh the fluentd Pods to apply the secure-forward secret and secure-forward ConfigMap:

```
$ oc delete pod --selector logging-infra=fluentd
```

5. Configure the secure-forward.conf file on the receiver to accept messages securely from OpenShift Container Platform.

When configuring the receiver, it must be able to accept messages securely from OpenShift Container Platform.

You can find further explanation of how to set up the in_forward plug-in and the out_forward plug-in.

### 8.11. CONFIGURING SYSTEMD-JOURNALD AND FLUENTD

Because Fluentd reads from the journal, and the journal default settings are very low, journal entries can be lost because the journal cannot keep up with the logging rate from system services.

We recommend setting `RateLimitInterval=1s` and `RateLimitBurst=10000` (or even higher if necessary) to prevent the journal from losing entries.

#### 8.11.1. Configuring systemd-journald for cluster logging

As you scale up your project, the default logging environment might need some adjustments.

For example, if you are missing logs, you might have to increase the rate limits for journald. You can adjust the number of messages to retain for a specified period of time to ensure that cluster logging does not use excessive resources without dropping logs.

You can also determine if you want the logs compressed, how long to retain logs, how or if the logs are stored, and other settings.

**Procedure**

1. Create a `journald.conf` file with the required settings:

```
Compress=no
ForwardToConsole=yes
ForwardToSyslog=no
MaxRetentionSec=30
RateLimitBurst=10000
RateLimitInterval=1s
Storage=volatile
SyncIntervalSec=1s
```
Specify whether you want logs compressed before they are written to the file system. Specify `yes` to compress the message or `no` to not compress. The default is `yes`.

Configure whether to forward log messages. Defaults to `no` for each. Specify:

- `ForwardToConsole` to forward logs to the system console.
- `ForwardToKsmg` to forward logs to the kernel log buffer.
- `ForwardToSyslog` to forward to a syslog daemon.
- `ForwardToWall` to forward messages as wall messages to all logged-in users.

Specify the maximum time to store journal entries. Enter a number to specify seconds. Or include a unit: "year", "month", "week", "day", "h" or "m". Enter 0 to disable. The default is `1month`.

Configure rate limiting. If, during the time interval defined by `RateLimitIntervalSec`, more logs than specified in `RateLimitBurst` are received, all further messages within the interval are dropped until the interval is over. It is recommended to set `RateLimitInterval=1s` and `RateLimitBurst=10000`, which are the defaults.

Specify how logs are stored. The default is `persistent`:

- `volatile` to store logs in memory in `/var/log/journal/`.
- `persistent` to store logs to disk in `/var/log/journal/`. systemd creates the directory if it does not exist.
- `auto` to store logs in in `/var/log/journal/` if the directory exists. If it does not exist, systemd temporarily stores logs in `/run/systemd/journal`.
- `none` to not store logs. systemd drops all logs.

Specify the timeout before synchronizing journal files to disk for `ERR`, `WARNING`, `NOTICE`, `INFO`, and `DEBUG` logs. systemd immediately syncs after receiving a `CRIT`, `ALERT`, or `EMERG` log. The default is `1s`.

Specify the maximum size the journal can use. The default is `8g`.

Specify how much disk space systemd must leave free. The default is `20%`.

Specify the maximum size for individual journal files stored persistently in `/var/log/journal`. The default is `10M`.

**NOTE**

If you are removing the rate limit, you might see increased CPU utilization on the system logging daemons as it processes any messages that would have previously been throttled.
For more information on systemd settings, see https://www.freedesktop.org/software/systemd/man/journald.conf.html. The default settings listed on that page might not apply to OpenShift Container Platform.

2. Convert the journal.conf file to base64:

```bash
$ export jrnl_cnf=$( cat /journald.conf | base64 -w0 )
```

3. Create a new MachineConfig for master or worker and add the journal.conf parameters:

   For example:

   ```yaml
   ...
   config:
     storage:
       files:
         - contents:
             source: data:text/plain;charset=utf-8;base64,${jrnl_cnf}
             verification: {}
             filesystem: root
             mode: 0644
             path: /etc/systemd/journald.conf
     systemd: {}
   ...
   ```

   1 Set the permissions for the journal.conf file. It is recommended to set 0644 permissions.
   2 Specify the path to the base64-encoded journal.conf file.

4. Create the MachineConfig:

   ```bash
   $ oc apply -f <filename>.yaml
   ```

   The controller detects the new MachineConfig and generates a new rendered-worker-<hash> version.

5. Monitor the status of the rollout of the new rendered configuration to each node:

   ```bash
   $ oc describe machineconfigpool/worker
   ```

   Name: worker
   Namespace:
   Labels: machineconfiguration.openshift.io/mco-built-in=
   Annotations: <none>
   API Version: machineconfiguration.openshift.io/v1
   Kind: MachineConfigPool
   ...

   Conditions:
   Message:
   Reason: All nodes are updating to rendered-worker-913514517bcea7c93bd446f4830bc64e
CHAPTER 9. VIEWING ELASTICSEARCH STATUS

You can view the status of the Elasticsearch Operator and for a number of Elasticsearch components.

9.1. VIEWING ELASTICSEARCH STATUS

You can view the status of your Elasticsearch cluster.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Change to the openshift-logging project.

   $ oc project openshift-logging

2. To view the Elasticsearch cluster status:

   a. Get the name of the Elasticsearch instance:

      $ oc get Elasticsearch

      NAME    AGE
      elasticsearch  5h9m

   b. Get the Elasticsearch status:

      $ oc get Elasticsearch <Elasticsearch-instance> -o yaml

      For example:

      $ oc get Elasticsearch elasticsearch -n openshift-logging -o yaml

      The output includes information similar to the following:

      status: 1
      cluster: 2
        activePrimaryShards: 30
        activeShards: 60
        initializingShards: 0
        numDataNodes: 3
        numNodes: 3
        pendingTasks: 0
        relocatingShards: 0
        status: green
        unassignedShards: 0
        clusterHealth: """"""""""""""
      conditions: [] 3
      nodes: 4
        - deploymentName: elasticsearch-cdm-zjf34ved-1
          upgradeStatus: {}
- deploymentName: elasticsearch-cdm-zjf34ved-2
  upgradeStatus: {}
- deploymentName: elasticsearch-cdm-zjf34ved-3
  upgradeStatus: {}
pods: 5
  client:
    failed: []
    notReady: []
    ready:
      - elasticsearch-cdm-zjf34ved-1-6d7fbf844f-sn422
      - elasticsearch-cdm-zjf34ved-2-dfbd988bc-qkzjz
      - elasticsearch-cdm-zjf34ved-3-c8f566f7c-t7zkt
data:
  failed: []
  notReady: []
  ready:
    - elasticsearch-cdm-zjf34ved-1-6d7fbf844f-sn422
    - elasticsearch-cdm-zjf34ved-2-dfbd988bc-qkzjz
    - elasticsearch-cdm-zjf34ved-3-c8f566f7c-t7zkt
master:
  failed: []
  notReady: []
  ready:
    - elasticsearch-cdm-zjf34ved-1-6d7fbf844f-sn422
    - elasticsearch-cdm-zjf34ved-2-dfbd988bc-qkzjz
    - elasticsearch-cdm-zjf34ved-3-c8f566f7c-t7zkt
shardAllocationEnabled: all

1 In the output, the cluster status fields appear in the **status** stanza.

2 The status of the Elasticsearch cluster:
   - The number of active primary shards.
   - The number of active shards.
   - The number of shards that are initializing.
   - The number of Elasticsearch data nodes.
   - The total number of Elasticsearch nodes.
   - The number of pending tasks.
   - The Elasticsearch status: **green, red, yellow**.
   - The number of unassigned shards.

3 Any status conditions, if present. The Elasticsearch cluster status indicates the reasons from the scheduler if a pod could not be placed. Any events related to the following conditions are shown:
   - Container Waiting for both the Elasticsearch and proxy containers.
   - Container Terminated for both the Elasticsearch and proxy containers.
- Pod unschedulable. Also, a condition is shown for a number of issues, see Example condition messages.

4 The Elasticsearch nodes in the cluster, with `upgradeStatus`.

5 The Elasticsearch client, data, and master pods in the cluster, listed under ‘failed’, `notReady` or `ready` state.

### 9.1.1. Example condition messages

The following are examples of some condition messages from the `Status` section of the Elasticsearch instance.

This status message indicates a node has exceeded the configured low watermark and no shard will be allocated to this node.

```json
status:
  nodes:
    - conditions:
          message: Disk storage usage for node is 27.5gb (36.74%). Shards will be not be allocated on this node.
          reason: Disk Watermark Low
          status: "True"
          type: NodeStorage
          deploymentName: example-elasticsearch-cdm-0-1
          upgradeStatus: {}
```

This status message indicates a node has exceeded the configured high watermark and shards will be relocated to other nodes.

```json
status:
  nodes:
    - conditions:
        - lastTransitionTime: 2019-03-15T16:04:45Z
          message: Disk storage usage for node is 27.5gb (36.74%). Shards will be relocated from this node.
          reason: Disk Watermark High
          status: "True"
          type: NodeStorage
          deploymentName: example-elasticsearch-cdm-0-1
          upgradeStatus: {}
```

This status message indicates the Elasticsearch node selector in the CR does not match any nodes in the cluster:

```json
status:
  nodes:
    - conditions:
        - lastTransitionTime: 2019-04-10T02:26:24Z
          message: '0/8 nodes are available: 8 node(s) didn't match node selector.'
          reason: Unschedulable
          status: "True"
          type: Unschedulable
```
This status message indicates that the Elasticsearch CR uses a non-existent PVC.

```
status:
  nodes:
    - conditions:
      - last Transition Time: 2019-04-10T05:55:51Z
        message:           pod has unbound immediate PersistentVolumeClaims (repeated 5 times)
        reason:            Unschedulable
        status:            True
        type:              Unschedulable
```

This status message indicates that your Elasticsearch cluster does not have enough nodes to support your Elasticsearch redundancy policy.

```
status:
  clusterHealth: ""
  conditions:
    - lastTransitionTime: 2019-04-17T20:01:31Z
      message: Wrong RedundancyPolicy selected. Choose different RedundancyPolicy or add more nodes with data roles
      reason: Invalid Settings
      status: "True"
      type: InvalidRedundancy
```

This status message indicates your cluster has too many master nodes:

```
status:
  clusterHealth: green
  conditions:
    - lastTransitionTime: '2019-04-17T20:12:34Z'
      message: >-
        Invalid master nodes count. Please ensure there are no more than 3 total nodes with master roles
      reason: Invalid Settings
      status: 'True'
      type: InvalidMasters
```

9.2. VIEWING ELASTICSEARCH COMPONENT STATUS

You can view the status for a number of Elasticsearch components.

**Elasticsearch indices**

You can view the status of the Elasticsearch indices.

1. Get the name of an Elasticsearch pod:

   ```
   $ oc get pods --selector component=elasticsearch -o name
   pod/elasticsearch-cdm-1godmszn-1-6f8495-vp4lw
   pod/elasticsearch-cdm-1godmszn-2-5769cf-9ms2n
   pod/elasticsearch-cdm-1godmszn-3-f66f7d-zqkz7
   ```

2. Get the status of the indices:
$ oc exec elasticsearch-cdm-1godmszn-1-6f8495-vp4lw -- indices

Defaulting container name to elasticsearch.
Use 'oc describe pod/elasticsearch-cdm-1godmszn-1-6f8495-vp4lw -n openshift-logging' to see all of the containers in this pod.
Wed Apr 10 05:42:12 UTC 2019
health status index        uuid                   pri rep docs.count
docs.deleted store.size pri.store.size
red   open   .kibana.647a750f1787408bf50088234ec0edd5a6a9b2ac N7iCbRjSSc2bGhn8Cpc7Jg   2   1
green  open   .operations.2019.04.10                           GTewEJEzQjaus9QjvBBnGg   3   1
2176114            0       3929           1956
green  open   .operations.2019.04.11                           ausZHoKxTNOoBvv9RIxfrw   3   1
1494624            0       2947           1475
green open .kibana                                          9Fltn1D0QHSnFMXpphZ--Q   1   1          1
0          0              0
green open .searchguard                                     chOwDnQlSsqhfSPcot1Yiw   1   1
5            1          0              0

Elasticsearch pods
You can view the status of the Elasticsearch pods.

1. Get the name of a pod:

   $ oc get pods --selector component=elasticsearch -o name
   pod/elasticsearch-cdm-1godmszn-1-6f8495-vp4lw
   pod/elasticsearch-cdm-1godmszn-2-5769cf-9ms2n
   pod/elasticsearch-cdm-1godmszn-3-f66f7d-zqkz7

2. Get the status of a pod:

   oc describe pod elasticsearch-cdm-1godmszn-1-6f8495-vp4lw

   The output includes the following status information:

   ....
   Status:    Running
   ....

   Containers:
   elasticsearch:
      Container ID:   cri-o://b7d44e0a9ea486e27f47763f5bb4c39dfd2
      State:          Running
      Started:      Mon, 08 Apr 2019 10:17:56 -0400
      Ready:          True
      Restart Count:  0
      Readiness:  exec [/usr/share/elasticsearch/probe/readiness.sh] delay=10s timeout=30s
                   period=5s #success=1 #failure=3
   ....
   proxy:
Elasticsearch deployment configuration

You can view the status of the Elasticsearch deployment configuration.

1. Get the name of a deployment configuration:

   $ oc get deployment --selector component=elasticsearch -o name

   deployment.extensions/elasticsearch-cdm-1gon-1
   deployment.extensions/elasticsearch-cdm-1gon-2
   deployment.extensions/elasticsearch-cdm-1gon-3

2. Get the deployment configuration status:

   $ oc describe deployment elasticsearch-cdm-1gon-1

   The output includes the following status information:

   Containers:
   elasticsearch:
      Image:  registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3
      Readiness:  exec [/usr/share/elasticsearch/probe/readiness.sh] delay=10s timeout=30s
                   period=5s #success=1 #failure=3

   Conditions:
   Type          Status  Reason
   ----          ------  -----
   Progressing   Unknown DeploymentPaused
   Available     True     MinimumReplicasAvailable
Elasticsearch ReplicaSet

You can view the status of the Elasticsearch ReplicaSet.

1. Get the name of a replica set:
   
   ```bash
   $ oc get replicaSet --selector component=elasticsearch -o name
   replicaset.extensions/elasticsearch-cdm-1gon-1-6f8495
   replicaset.extensions/elasticsearch-cdm-1gon-2-5769cf
   replicaset.extensions/elasticsearch-cdm-1gon-3-f66f7d
   ```

2. Get the status of the replica set:

   ```bash
   $ oc describe replicaSet elasticsearch-cdm-1gon-1-6f8495
   ```

   The output includes the following status information:

   ```
   ....
   Containers:
   elasticsearch:
   ... Image: registry.redhat.io/openshift4/ose-logging-elasticsearch5:v4.3
   Readiness: exec [/usr/share/elasticsearch/probe/readiness.sh] delay=10s timeout=30s
   period=5s #success=1 #failure=3
   ....
   ```

   Events: <none>
CHAPTER 10. VIEWING CLUSTER LOGGING STATUS

You can view the status of the Cluster Logging Operator and for a number of cluster logging components.

10.1. VIEWING THE STATUS OF THE CLUSTER LOGGING OPERATOR

You can view the status of your Cluster Logging Operator.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

1. Change to the `openshift-logging` project.
   
   `$ oc project openshift-logging`

2. To view the cluster logging status:
   
   a. Get the cluster logging status:

   `$ oc get clusterlogging instance -o yaml`

   The output includes information similar to the following:

   ```yaml
   apiVersion: logging.openshift.io/v1
   kind: ClusterLogging
   ....
   status:
   collection:
   logs:
     fluentdStatus:
     daemonSet: fluentd
     nodes:
       fluentd-2rhqp: ip-10-0-169-13.ec2.internal
       fluentd-6fgjh: ip-10-0-165-244.ec2.internal
       fluentd-6l2ff: ip-10-0-128-218.ec2.internal
       fluentd-54nx5: ip-10-0-139-30.ec2.internal
       fluentd-flpnn: ip-10-0-147-228.ec2.internal
       fluentd-n2frh: ip-10-0-157-45.ec2.internal
   pods:
   failed: []
   notReady: []
   ready:
   - fluentd-2rhqp
   - fluentd-54nx5
   - fluentd-6fgjh
   - fluentd-6l2ff
   - fluentd-flpnn
   - fluentd-n2frh
   ```
curation:

curatorStatus:
- cronJobs: curator
  schedules: 30 3 * * *
  suspended: false

logstore:
elasticsearchStatus:
- ShardAllocationEnabled: all
  cluster:
    activePrimaryShards: 5
    activeShards: 5
    initializingShards: 0
    numDataNodes: 1
    numNodes: 1
    pendingTasks: 0
    relocatingShards: 0
    status: green
    unassignedShards: 0
  clusterName: elasticsearch
  nodeConditions:
    elasticsearch-cdm-mkkdys93-1:
      nodeCount: 1
  pods:
    client:
      failed: []
      notReady: []
      ready:
        - elasticsearch-cdm-mkkdys93-1-7f7c6-mjm7c
  data:
    failed: []
    notReady: []
    ready:
      - elasticsearch-cdm-mkkdys93-1-7f7c6-mjm7c
  master:
    failed: []
    notReady: []
    ready:
      - elasticsearch-cdm-mkkdys93-1-7f7c6-mjm7c

visualization:
kibanaStatus:
- deployment: kibana
  pods:
    failed: []
    notReady: []
    ready:
      - kibana-7fb4fd4cc9-f2nls
  replicaSets:
    - kibana-7fb4fd4cc9
    replicas: 1

1. In the output, the cluster status fields appear in the `status` stanza.
2. Information on the Fluentd pods.
3. Information on the Curator pods.
Information on the Elasticsearch pods, including Elasticsearch cluster health, green, yellow, or red.

Information on the Kibana pods.

10.1.1. Example condition messages

The following are examples of some condition messages from the Status.Nodes section of the cluster logging instance.

A status message similar to the following indicates a node has exceeded the configured low watermark and no shard will be allocated to this node:

```
nodes:
  - conditions:
      message: Disk storage usage for node is 27.5gb (36.74%). Shards will be not be allocated on this node.
      reason: Disk Watermark Low
      status: "True"
      type: NodeStorage
      deploymentName: example-elasticsearch-clientdatamaster-0-1
      upgradeStatus: {}
```

A status message similar to the following indicates a node has exceeded the configured high watermark and shards will be relocated to other nodes:

```
nodes:
  - conditions:
    - lastTransitionTime: 2019-03-15T16:04:45Z
      message: Disk storage usage for node is 27.5gb (36.74%). Shards will be relocated from this node.
      reason: Disk Watermark High
      status: "True"
      type: NodeStorage
      deploymentName: cluster-logging-operator
      upgradeStatus: {}
```

A status message similar to the following indicates the Elasticsearch node selector in the CR does not match any nodes in the cluster:

```
Elasticsearch Status:
  Shard Allocation Enabled: shard allocation unknown
Cluster:
  Active Primary Shards: 0
  Active Shards: 0
  Initializing Shards: 0
  Num Data Nodes: 0
  Num Nodes: 0
  Pending Tasks: 0
  Relocating Shards: 0
  Status: cluster health unknown
  Unassigned Shards: 0
Cluster Name: elasticsearch
```
Node Conditions:
elasticsearch-cdm-mkkdys93-1:
   Last Transition Time:  2019-06-26T03:37:32Z
   Message:               0/5 nodes are available: 5 node(s) didn't match node selector.
   Reason:                Unschedulable
   Status:                True
   Type:                  Unschedulable
elasticsearch-cdm-mkkdys93-2:
Node Count:  2
Pods:
   Client:
      Failed:
      Not Ready:
         elasticsearch-cdm-mkkdys93-1-75dd69dcd-df7f49
         elasticsearch-cdm-mkkdys93-2-67c64f5f4c-n58vl
      Ready:
   Data:
      Failed:
      Not Ready:
         elasticsearch-cdm-mkkdys93-1-75dd69dcd-df7f49
         elasticsearch-cdm-mkkdys93-2-67c64f5f4c-n58vl
      Ready:
   Master:
      Failed:
      Not Ready:
         elasticsearch-cdm-mkkdys93-1-75dd69dcd-df7f49
         elasticsearch-cdm-mkkdys93-2-67c64f5f4c-n58vl
      Ready:

A status message similar to the following indicates that the requested PVC could not bind to PV:

Node Conditions:
elasticsearch-cdm-mkkdys93-1:
   Last Transition Time:  2019-06-26T03:37:32Z
   Message:               pod has unbound immediate PersistentVolumeClaims (repeated 5 times)
   Reason:                Unschedulable
   Status:                True
   Type:                  Unschedulable

A status message similar to the following indicates that the Curator pod cannot be scheduled because
the node selector did not match any nodes:

Curation:
   Curator Status:
   Cluster Condition:
      curator-1561518900-cjx8d:
         Last Transition Time:  2019-06-26T03:37:32Z
         Message:               0/5 nodes are available: 1 Insufficient cpu, 5 node(s) didn't match node
         Reason:                Unschedulable
         Status:                True
         Type:                  ContainerTerminated
curator-1561519200-zqxxj:
         Last Transition Time:  2019-06-26T03:20:01Z
         Message:               0/5 nodes are available: 1 Insufficient cpu, 5 node(s) didn't match node
         Reason:                Unschedulable
A status message similar to the following indicates that the Fluentd pods cannot be scheduled because the node selector did not match any nodes:

**Status:**
Collection:
Logs:
Fluentd Status:
  Daemon Set: fluentd
Nodes:
Pods:
  Failed:
  Not Ready:
  Ready:

### 10.2. VIEWING THE STATUS OF CLUSTER LOGGING COMPONENTS

You can view the status for a number of cluster logging components.

**Prerequisites**

- Cluster logging and Elasticsearch must be installed.

**Procedure**

1. Change to the *openshift-logging* project.

   ```bash
   $ oc project openshift-logging
   ```

2. View the status of the cluster logging deployment:

   ```bash
   $ oc describe deployment cluster-logging-operator
   ```

   The output includes the following status information:

   **Name:** cluster-logging-operator

   ....

   **Conditions:**
<table>
<thead>
<tr>
<th>Type</th>
<th>Status</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available</td>
<td>True</td>
<td>MinimumReplicasAvailable</td>
</tr>
<tr>
<td>Progressing</td>
<td>True</td>
<td>NewReplicaSetAvailable</td>
</tr>
</tbody>
</table>

   ....

   **Events:**

   ....
3. View the status of the cluster logging ReplicaSet:

   a. Get the name of a ReplicaSet:

   
   ```sh
   $ oc get replicaset
   NAME                                      DESIRED  CURRENT  READY  AGE
   cluster-logging-operator-574b8987df       1        1         1  159m
   elasticsearch-cdm-uhr537yu-1-6869694fb   1        1         1  157m
   elasticsearch-cdm-uhr537yu-2-857b6d676f   1        1         1  156m
   elasticsearch-cdm-uhr537yu-3-5b6fdd8cfd   1        1         1  155m
   kibana-5bd5544f87                         1        1         1  157m
   ```

   b. Get the status of the ReplicaSet:

   ```sh
   $ oc describe replicaset cluster-logging-operator-574b8987df
   ```

   The output includes the following status information:

   ```
   Name: cluster-logging-operator-574b8987df
   
   Replicas: 1 current / 1 desired
   Pods Status: 1 Running / 0 Waiting / 0 Succeeded / 0 Failed
   
   Events:
   ```
CHAPTER 11. MOVING THE CLUSTER LOGGING RESOURCES WITH NODE SELECTORS

You use node selectors to deploy the Elasticsearch, Kibana, and Curator pods to different nodes.

11.1. MOVING THE CLUSTER LOGGING RESOURCES

You can configure the Cluster Logging Operator to deploy the pods for any or all of the Cluster Logging components, Elasticsearch, Kibana, and Curator to different nodes. You cannot move the Cluster Logging Operator pod from its installed location.

For example, you can move the Elasticsearch pods to a separate node because of high CPU, memory, and disk requirements.

NOTE

You should set your MachineSet to use at least 6 replicas.

Prerequisites

- Cluster logging and Elasticsearch must be installed. These features are not installed by default.

Procedure

1. Edit the Cluster Logging Custom Resource in the openshift-logging project:

```yaml
$ oc edit ClusterLogging instance

apiVersion: logging.openshift.io/v1
kind: ClusterLogging

....

spec:
  collection:
    logs:
      fluentd:
        resources: null
        type: fluentd
    curator:
      nodeSelector:  
        node-role.kubernetes.io/infra: "
        resources: null
        schedule: 30 3 * * *
        type: curator
    logStore:
      elasticsearch:
        nodeCount: 3
        nodeSelector:  
          node-role.kubernetes.io/infra: "
        redundancyPolicy: SingleRedundancy
        resources:
```
Add a `nodeSelector` parameter with the appropriate value to the component you want to move. You can use a `nodeSelector` in the format shown or use `<key>: <value>` pairs, based on the value specified for the node.
CHAPTER 12. MANUALLY ROLLING OUT ELASTICSEARCH

OpenShift Container Platform supports the Elasticsearch rolling cluster restart. A rolling restart applies appropriate changes to the Elasticsearch cluster without down time (if three masters are configured). The Elasticsearch cluster remains online and operational, with nodes taken offline one at a time.

12.1. PERFORMING AN ELASTICSEARCH ROLLING CLUSTER RESTART

Perform a rolling restart when you change the `elasticsearch` configmap or any of the `elasticsearch-*` deployment configurations.

Also, a rolling restart is recommended if the nodes on which an Elasticsearch pod runs requires a reboot.

Prerequisite

- Cluster logging and Elasticsearch must be installed.

Procedure

To perform a rolling cluster restart:

1. Change to the `openshift-logging` project:
   
   $ oc project openshift-logging

2. Use the following command to extract the CA certificate from Elasticsearch and write to the `admin-ca` file:
   
   $ oc extract secret/elasticsearch --to=. --keys=admin-ca

3. Perform a shard synced flush to ensure there are no pending operations waiting to be written to disk prior to shutting down:
   
   $ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- curl -s --cacert /etc/elasticsearch/secret/admin-ca --cert /etc/elasticsearch/secret/admin-cert --key /etc/elasticsearch/secret/admin-key -XPOST 'https://localhost:9200/_flush/synced'
   
   For example:
   
   oc exec -c elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -- curl -s --cacert /etc/elasticsearch/secret/admin-ca --cert /etc/elasticsearch/secret/admin-cert --key /etc/elasticsearch/secret/admin-key -XPOST 'https://localhost:9200/_flush/synced'

4. Prevent shard balancing when purposely bringing down nodes using the OpenShift Container Platform `es_util` tool:
   
   $ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- es_util --query=_cluster/settings -XPUT 'https://localhost:9200/_cluster/settings' -d '{ "transient": { "cluster.routing.allocation.enable": "none" } }'
   
   For example:
   
   oc exec -c elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -- es_util --query=_cluster/settings -XPUT 'https://localhost:9200/_cluster/settings' -d '{ "transient": { "cluster.routing.allocation.enable": "none" } }'
5. Once complete, for each deployment you have for an ES cluster:

   a. By default, the OpenShift Container Platform Elasticsearch cluster blocks rollouts to their nodes. Use the following command to allow rollouts and allow the pod to pick up the changes:

   ```sh
   $ oc rollout resume deployment/<deployment-name>
   ```

   For example:

   ```sh
   $ oc rollout resume deployment/elasticsearch-cdm-0-1
   deployment.extensions/elasticsearch-cdm-0-1 resumed
   ```

   A new pod is deployed. Once the pod has a ready container, you can move on to the next deployment.

   ```sh
   $ oc get pods | grep elasticsearch-
   ```

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6k</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>22h</td>
</tr>
<tr>
<td>elasticsearch-cdm-5ceex6ts-2-f799564cb-19mjj7</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>22h</td>
</tr>
<tr>
<td>elasticsearch-cdm-5ceex6ts-3-585968dc68-k7kjr</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>22h</td>
</tr>
</tbody>
</table>

   b. Once complete, reset the pod to disallow rollouts:

   ```sh
   $ oc rollout pause deployment/<deployment-name>
   ```

   For example:

   ```sh
   $ oc rollout pause deployment/elasticsearch-cdm-0-1
   deployment.extensions/elasticsearch-cdm-0-1 paused
   ```

   c. Check that the Elasticsearch cluster is in **green** state:

   ```sh
   $ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- es_util --
   query=_cluster/health?pretty=true
   ```
If you performed a rollout on the Elasticsearch pod you used in the previous commands, the pod no longer exists and you need a new pod name here. For example:

```
$ oc exec elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -c elasticsearch -- es_util --
query=\_cluster/health?pretty=true

{
  "cluster_name": "elasticsearch",
  "status": "green",
  "timed_out": false,
  "number_of_nodes": 3,
  "number_of_data_nodes": 3,
  "active_primary_shards": 8,
  "active_shards": 16,
  "relocating_shards": 0,
  "initializing_shards": 0,
  "unassigned_shards": 1,
  "delayed_unassigned_shards": 0,
  "number_of_pending_tasks": 0,
  "number_of_in_flight_fetch": 0,
  "task_max_waiting_in_queue_millis": 0,
  "active_shards_percent_as_number": 100.0
}
```

1. Make sure this parameter is **green** before proceeding.

6. If you changed the Elasticsearch configuration map, repeat these steps for each Elasticsearch pod.

7. Once all the deployments for the cluster have been rolled out, re-enable shard balancing:

```
$ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- es_util --query=\_cluster/settings
-XPUT 'https://localhost:9200/_cluster/settings' -d '{ "transient": {
    "cluster.routing.allocation.enable": "none" }
}'
```

For example:

```
$ oc exec elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -c elasticsearch -- es_util --
    "transient": { "cluster.routing.allocation.enable": "all" }
}'

{
  "acknowledged": true,
  "persistent": { },
  "transient": {
    "cluster": {
      "routing": {
        "allocation": {
```
"enable" : "all"
CHAPTER 13. TROUBLESHOOTING KIBANA

Using the Kibana console with OpenShift Container Platform can cause problems that are easily solved, but are not accompanied with useful error messages. Check the following troubleshooting sections if you are experiencing any problems when deploying Kibana on OpenShift Container Platform.

13.1. TROUBLESHOOTING A KUBERNETES LOGIN LOOP

The OAuth2 proxy on the Kibana console must share a secret with the master host’s OAuth2 server. If the secret is not identical on both servers, it can cause a login loop where you are continuously redirected back to the Kibana login page.

Procedure
To fix this issue:

1. Run the following command to delete the current OAuthClient:

   $ oc delete oauthclient/kibana-proxy

13.2. TROUBLESHOOTING A KUBERNETES CRYPTIC ERROR WHEN VIEWING THE KIBANA CONSOLE

When attempting to visit the Kibana console, you may receive a browser error instead:

   ```json
   {"error":"invalid_request","error_description":"The request is missing a required parameter, includes an invalid parameter value, includes a parameter more than once, or is otherwise malformed."}
   ```

This can be caused by a mismatch between the OAuth2 client and server. The return address for the client must be in a whitelist so the server can securely redirect back after logging in.

Fix this issue by replacing the OAuthClient entry.

Procedure
To replace the OAuthClient entry:

1. Run the following command to delete the current OAuthClient:

   $ oc delete oauthclient/kibana-proxy

   If the problem persists, check that you are accessing Kibana at a URL listed in the OAuth client. This issue can be caused by accessing the URL at a forwarded port, such as 1443 instead of the standard 443 HTTPS port. You can adjust the server whitelist by editing the OAuth client:

   $ oc edit oauthclient/kibana-proxy

13.3. TROUBLESHOOTING A KUBERNETES 503 ERROR WHEN VIEWING THE KIBANA CONSOLE

If you receive a proxy error when viewing the Kibana console, it could be caused by one of two issues:
- Kibana might not be recognizing pods. If Elasticsearch is slow in starting up, Kibana may timeout trying to reach it. Check whether the relevant service has any endpoints:

```
$ oc describe service kibana
Name:                   kibana
[...]                  
Endpoints:              <none>
```

If any Kibana pods are live, endpoints are listed. If they are not, check the state of the Kibana pods and deployment. You might have to scale the deployment down and back up again.

- The route for accessing the Kibana service is masked. This can happen if you perform a test deployment in one project, then deploy in a different project without completely removing the first deployment. When multiple routes are sent to the same destination, the default router will only route to the first created. Check the problematic route to see if it is defined in multiple places:

```
$ oc get route --all-namespaces --selector logging-infra=support
```
CHAPTER 14. EXPORTED FIELDS

These are the fields exported by the logging system and available for searching from Elasticsearch and Kibana. Use the full, dotted field name when searching. For example, for an Elasticsearch /_search URL, to look for a Kubernetes Pod name, use /_search?q=kubernetes.pod_name:name-of-my-pod.

The following sections describe fields that may not be present in your logging store. Not all of these fields are present in every record. The fields are grouped in the following categories:

- exported-fields-Default
- exported-fields-systemd
- exported-fields-kubernetes
- exported-fields-pipeline_metadata
- exported-fields-ovirt
- exported-fields-aushape
- exported-fields-tlog

14.1. DEFAULT EXPORTED FIELDS

These are the default fields exported by the logging system and available for searching from Elasticsearch and Kibana. The default fields are Top Level and collectd*.

Top Level Fields
The top level fields are common to every application, and may be present in every record. For the Elasticsearch template, top level fields populate the actual mappings of default in the template’s mapping section.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@timestamp</td>
<td>The UTC value marking when the log payload was created, or when the log payload was first collected if the creation time is not known. This is the log processing pipeline’s best effort determination of when the log payload was generated. Add the @ prefix convention to note a field as being reserved for a particular use. With Elasticsearch, most tools look for @timestamp by default. For example, the format would be 2015-01-24 14:06:05.071000.</td>
</tr>
<tr>
<td>geoip</td>
<td>This is geo-ip of the machine.</td>
</tr>
<tr>
<td>hostname</td>
<td>The hostname is the fully qualified domain name (FQDN) of the entity generating the original payload. This field is an attempt to derive this context. Sometimes the entity generating it knows the context. While other times that entity has a restricted namespace itself, which is known by the collector or normalizer.</td>
</tr>
<tr>
<td>ipaddr4</td>
<td>The IP address V4 of the source server, which can be an array.</td>
</tr>
<tr>
<td>ipaddr6</td>
<td>The IP address V6 of the source server, if available.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>level</strong></td>
<td>The logging level as provided by rsyslog (severitytext property), python’s logging module. Possible values are as listed at <code>misc/sys/syslog.h</code> plus <code>trace</code> and <code>unknown</code>. For example, “alert crit debug emerg err info notice trace unknown warning”. Note that <code>trace</code> is not in the <code>syslog.h</code> list but many applications use it.</td>
</tr>
<tr>
<td></td>
<td>. You should only use <code>unknown</code> when the logging system gets a value it does not understand, and note that it is the highest level. Consider <code>trace</code> as higher or more verbose, than <code>debug</code>. <code>error</code> is deprecated, use <code>err</code> . Convert <code>panic</code> to <code>emerg</code> . Convert <code>warn</code> to <code>warning</code>.</td>
</tr>
<tr>
<td></td>
<td>Numeric values from <code>syslog/journal PRIORITY</code> can usually be mapped using the priority values as listed at <code>misc/sys/syslog.h</code>.</td>
</tr>
<tr>
<td></td>
<td>Log levels and priorities from other logging systems should be mapped to the nearest match. See python logging for an example.</td>
</tr>
<tr>
<td><strong>message</strong></td>
<td>A typical log entry message, or payload. It can be stripped of metadata pulled out of it by the collector or normalizer, that is UTF-8 encoded.</td>
</tr>
<tr>
<td><strong>pid</strong></td>
<td>This is the process ID of the logging entity, if available.</td>
</tr>
<tr>
<td><strong>service</strong></td>
<td>The name of the service associated with the logging entity, if available. For example, the <code>syslog APP-NAME</code> property is mapped to the service field.</td>
</tr>
<tr>
<td><strong>tags</strong></td>
<td>Optionally provided operator defined list of tags placed on each log by the collector or normalizer. The payload can be a string with whitespace-delimited string tokens, or a JSON list of string tokens.</td>
</tr>
<tr>
<td><strong>file</strong></td>
<td>Optional path to the file containing the log entry local to the collector TODO analyzer for file paths.</td>
</tr>
<tr>
<td><strong>offset</strong></td>
<td>The offset value can represent bytes to the start of the log line in the file (zero or one based), or log line numbers (zero or one based), as long as the values are strictly monotonically increasing in the context of a single log file. The values are allowed to wrap, representing a new version of the log file (rotation).</td>
</tr>
<tr>
<td><strong>namespace_name</strong></td>
<td>Associate this record with the namespace that shares it’s name. This value will not be stored, but it is used to associate the record with the appropriate namespace for access control and visualization. Normally this value will be given in the tag, but if the protocol does not support sending a tag, this field can be used. If this field is present, it will override the namespace given in the tag or in kubernetes.namespace_name.</td>
</tr>
<tr>
<td><strong>namespace_uuid</strong></td>
<td>This is the uuid associated with the namespace_name. This value will not be stored, but is used to associate the record with the appropriate namespace for access control and visualization. If this field is present, it will override the uuid given in kubernetes.namespace_uuid. This will also cause the Kubernetes metadata lookup to be skipped for this log record.</td>
</tr>
</tbody>
</table>
**collectd Fields**  
The following fields represent namespace metrics metadata.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.interval    | type: float  
                    The `collectd` interval. |
| collectd.plugin      | type: string  
                    The `collectd` plug-in. |
| collectd.plugin_instance | type: string  
                    The `collectd` plugin_instance. |
| collectd.type_instance | type: string  
                    The `collectd` type_instance. |
| collectd.type        | type: string  
                    The `collectd` type. |
| collectd.dstypes     | type: string  
                    The `collectd` dstypes. |

**collectd.processes Fields**  
The following field corresponds to the `collectd` processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.processes.ps_state      | type: integer  
                    The `collectd` ps_state type of processes plug-in. |

**collectd.processes.ps_disk_ops Fields**  
The `collectd` ps_disk_ops type of processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.processes.ps_disk_ops.read | type: float  
                    TODO |
| collectd.processes.ps_disk_ops.write | type: float  
                    TODO |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.processes.ps_vm</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd ps_vm</code> type of processes plug-in.</td>
</tr>
<tr>
<td><code>collectd.processes.ps_rss</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd ps_rss</code> type of processes plug-in.</td>
</tr>
<tr>
<td><code>collectd.processes.ps_data</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd ps_data</code> type of processes plug-in.</td>
</tr>
<tr>
<td><code>collectd.processes.ps_code</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd ps_code</code> type of processes plug-in.</td>
</tr>
<tr>
<td><code>collectd.processes.ps_stacksize</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd ps_stacksize</code> type of processes plug-in.</td>
</tr>
</tbody>
</table>

**collectd.processes.ps_cputime** Fields  
The `collectd ps_cputime` type of processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.processes.ps_cputime.user</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.processes.ps_cputime.syst</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

**collectd.processes.ps_count** Fields  
The `collectd ps_count` type of processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.processes.ps_count.processes</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.processes.ps_count.threads</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

**collectd.processes.ps_pagefaults** Fields
The `collectd ps_pagefaults` type of processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.processes.ps_pagefaults.majflt` | type: float
| TODO |
| `collectd.processes.ps_pagefaults.minflt` | type: float
| TODO |

`collectd.processes.ps_disk_octets` Fields
The `collectd ps_disk_octets` type of processes plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.processes.ps_disk_octets.read` | type: float
| TODO |
| `collectd.processes.ps_disk_octets.write` | type: float
| TODO |
| `collectd.processes.fork_rate` | type: float
| The `collectd fork_rate` type of processes plug-in |

`collectd.disk` Fields
Corresponds to `collectd` disk plug-in.

`collectd.disk.disk_merged` Fields
The `collectd disk_merged` type of disk plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.disk.disk_merged.read` | type: float
| TODO |
| `collectd.disk.disk_merged.write` | type: float
| TODO |

`collectd.disk.disk_octets` Fields
The `collectd disk_octets` type of disk plug-in.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.disk.disk_octets.read | type: float  
TODO |
| collectd.disk.disk_octets.write | type: float  
TODO |

**collectd.disk.disk_time Fields**  
The *collectd disk_time* type of disk plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.disk.disk_time.read | type: float  
TODO |
| collectd.disk.disk_time.write | type: float  
TODO |

**collectd.disk.disk_ops Fields**  
The *collectd disk_ops* type of disk plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.disk.disk_ops.read | type: float  
TODO |
| collectd.disk.disk_ops.write | type: float  
TODO |
| collectd.disk.pending_operations | type: integer  
The *collectd pending_operations* type of disk plug-in. |

**collectd.disk.disk_io_time Fields**  
The *collectd disk_io_time* type of disk plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.disk.disk_io_time.io_time | type: float  
TODO |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.disk.disk_io_time.weighted_io_time</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

**collectd.interface Fields**  
Corresponds to the `collectd` interface plug-in.

**collectd.interface.if_octets Fields**  
The `collectd if_octets` type of interface plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.interface.if_octets.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>collectd.interface.if_octets.tx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

**collectd.interface.if_packets Fields**  
The `collectd if_packets` type of interface plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.interface.if_packets.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>collectd.interface.if_packets.tx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

**collectd.interface.if_errors Fields**  
The `collectd if_errors` type of interface plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.interface.if_errors.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>collectd.interface.if_errors.tx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>
**collectd.interface.if_dropped Fields**
The **collectd if_dropped** type of interface plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.interface.if_dropped.rx` | type: float  
 | TODO                      |
| `collectd.interface.if_dropped.tx` | type: float  
 | TODO                      |

**collectd.virt Fields**
Corresponds to **collectd** virt plug-in.

**collectd.virt.if_octets Fields**
The **collectd if_octets** type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.virt.if_octets.rx` | type: float  
 | TODO                      |
| `collectd.virt.if_octets.tx` | type: float  
 | TODO                      |

**collectd.virt.if_packets Fields**
The **collectd if_packets** type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.virt.if_packets.rx` | type: float  
 | TODO                      |
| `collectd.virt.if_packets.tx` | type: float  
 | TODO                      |

**collectd.virt.if_errors Fields**
The **collectd if_errors** type of virt plug-in.
### collectd.virt.if_errors Fields
The `collectd.virt.if_errors` type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.virt.if_errors.rx</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.virt.if_errors.tx</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

### collectd.virt.if_dropped Fields
The `collectd.virt.if_dropped` type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.virt.if_dropped.rx</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.virt.if_dropped.tx</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

### collectd.virt.disk_ops Fields
The `collectd.virt.disk_ops` type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.virt.disk_ops.read</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.virt.disk_ops.write</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

### collectd.virt.disk_octets Fields
The `collectd.virt.disk_octets` type of virt plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.virt.disk_octets.read</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td><code>collectd.virt.disk_octets.write</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>collectd.virt.memory</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> memory type of virt plug-in.</td>
</tr>
<tr>
<td>collectd.virt.virt_vcpu</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> <code>virt_vcpu</code> type of virt plug-in.</td>
</tr>
<tr>
<td>collectd.virt.virt_cpu_total</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> <code>virt_cpu_total</code> type of virt plug-in.</td>
</tr>
</tbody>
</table>

**collectd.CPU Fields**
Corresponds to the `collectd` CPU plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.CPU.percent</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> type percent of plug-in CPU.</td>
</tr>
</tbody>
</table>

**collectd.df Fields**
Corresponds to the `collectd df` plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.df.df_complex</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> type <code>df_complex</code> of plug-in <code>df</code>.</td>
</tr>
<tr>
<td>collectd.df.percent_bytes</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> type <code>percent_bytes</code> of plug-in <code>df</code>.</td>
</tr>
</tbody>
</table>

**collectd.entropy Fields**
Corresponds to the `collectd` entropy plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.entropy.entropy</td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> entropy type of entropy plug-in.</td>
</tr>
</tbody>
</table>

**collectd.memory Fields**
Corresponds to the `collectd` memory plug-in.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.memory.memory  | type: float
The `collectd` memory type of memory plug-in. |
| collectd.memory.percent | type: float
The `collectd` percent type of memory plug-in. |

**collectd.swap** Fields
Corresponds to the `collectd` swap plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.swap.swap      | type: integer
The `collectd` swap type of swap plug-in.     |
| collectd.swap.swap_io   | type: integer
The `collectd swap_io` type of swap plug-in.  |

**collectd.load** Fields
Corresponds to the `collectd` load plug-in.

**collectd.load.load** Fields
The `collectd` load type of load plug-in

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| collectd.load.load.shortterm | type: float
TODO                        |
| collectd.load.load midterm   | type: float
TODO                        |
| collectd.load.load.longterm   | type: float
TODO                        |

**collectd.aggregation** Fields
Corresponds to `collectd` aggregation plug-in.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.aggregation.percent</td>
<td>type: float TODO</td>
</tr>
</tbody>
</table>

**collectd.statsd Fields**

Corresponds to **collectd statsd** plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.statsd.host_cpu</td>
<td>type: integer  The <strong>collectd</strong> CPU type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_elapsed_time</td>
<td>type: integer  The <strong>collectd elapsed_time</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_memory</td>
<td>type: integer  The <strong>collectd memory</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_speed</td>
<td>type: integer  The <strong>collectd nic_speed</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_rx</td>
<td>type: integer  The <strong>collectd nic_rx</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_tx</td>
<td>type: integer  The <strong>collectd nic_tx</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_rx_dropped</td>
<td>type: integer  The <strong>collectd nic_rx_dropped</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_tx_dropped</td>
<td>type: integer  The <strong>collectd nic_tx_dropped</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_rx_errors</td>
<td>type: integer  The <strong>collectd nic_rx_errors</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>collectd.statsd.host_nic_tx_errors</td>
<td>type: integer  The <strong>collectd nic_tx_errors</strong> type of <strong>statsd</strong> plug-in.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>collectd.statsd.host_storage</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> storage type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_swap</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> swap type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_vdsm</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> VDSM type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_vms</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> VMS type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_nic_tx_dropped</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_tx_dropped</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_nic_rx_bytes</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_rx_bytes</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_nic_tx_bytes</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_tx_bytes</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_balloon_min</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd balloon_min</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_balloon_max</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd balloon_max</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_balloon_target</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd balloon_target</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_balloon_cur</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd balloon_cur</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_cpu_sys</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd cpu_sys</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_cpu_usage</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd cpu_usage</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_read_ops</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_read_ops</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_write_ops</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_write_ops</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_flush_latency</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_flush_latency</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_apparent_size</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_apparent_size</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_write_bytes</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_write_bytes</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_write_rate</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_write_rate</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_true_size</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_true_size</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_read_rate</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_read_rate</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_write_latency</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_write_latency</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_read_latency</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_read_latency</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.vm_disk_read_bytes</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd disk_read_bytes</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| `collectd.statsd.vm_nic_rx_dropped` | type: integer  
The `collectd nic_rx_dropped` type of `statsd` plug-in. |
| `collectd.statsd.vm_cpu_user` | type: integer  
The `collectd cpu_user` type of `statsd` plug-in. |
| `collectd.statsd.vm_nic_rx_errors` | type: integer  
The `collectd nic_rx_errors` type of `statsd` plug-in. |
| `collectd.statsd.vm_nic_tx_errors` | type: integer  
The `collectd nic_tx_errors` type of `statsd` plug-in. |
| `collectd.statsd.vm_nic_speed` | type: integer  
The `collectd nic_speed` type of `statsd` plug-in. |

**collectd.postgresql Fields**
Corresponds to `collectd postgresql` plug-in.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.postgresql.pg_n_tup_g` | type: integer  
The `collectd` type `pg_n_tup_g` of plug-in `postgresql`. |
| `collectd.postgresql.pg_n_tup_c` | type: integer  
The `collectd` type `pg_n_tup_c` of plug-in `postgresql`. |
| `collectd.postgresql.pg_numbackends` | type: integer  
The `collectd` type `pg_numbackends` of plug-in `postgresql`. |
| `collectd.postgresql.pg_xact` | type: integer  
The `collectd` type `pg_xact` of plug-in `postgresql`. |
| `collectd.postgresql.pg_db_size` | type: integer  
The `collectd` type `pg_db_size` of plug-in `postgresql`. |
| `collectd.postgresql.pg_blks` | type: integer  
The `collectd` type `pg_blks` of plug-in `postgresql`. |
14.2. **SYSTEMD EXPORTED FIELDS**

These are the **systemd** fields exported by the OpenShift Container Platform cluster logging available for searching from Elasticsearch and Kibana.

Contains common fields specific to **systemd** journal. **Applications** may write their own fields to the journal. These will be available under the **systemd.u** namespace. **RESULT** and **UNIT** are two such fields.

**systemd.k Fields**
The following table contains **systemd** kernel-specific metadata.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>systemd.k.KERNEL_DEVICE</td>
<td><strong>systemd.k.KERNEL_DEVICE</strong> is the kernel device name.</td>
</tr>
<tr>
<td>systemd.k.KERNEL_SUBSYSTEM</td>
<td><strong>systemd.k.KERNEL_SUBSYSTEM</strong> is the kernel subsystem name.</td>
</tr>
<tr>
<td>systemd.k.UDEV_DEVLINK</td>
<td><strong>systemd.k.UDEV_DEVLINK</strong> includes additional symlink names that point to the node.</td>
</tr>
<tr>
<td>systemd.k.UDEV_DEVNODE</td>
<td><strong>systemd.k.UDEV_DEVNODE</strong> is the node path of the device.</td>
</tr>
<tr>
<td>systemd.k.UDEV_SYSTYPE</td>
<td><strong>systemd.k.UDEV_SYSTYPE</strong> is the kernel device name.</td>
</tr>
</tbody>
</table>

**systemd.t Fields**
**systemd.t Fields** are trusted journal fields, fields that are implicitly added by the journal, and cannot be altered by client code.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>systemd.t.AUDIT_LOGINUID</td>
<td><strong>systemd.t.AUDIT_LOGINUID</strong> is the user ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.BOOT_ID</td>
<td><strong>systemd.t.BOOT_ID</strong> is the kernel boot ID.</td>
</tr>
<tr>
<td>systemd.t.AUDIT_SESSION</td>
<td><strong>systemd.t.AUDIT_SESSION</strong> is the session for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.CAP_EFFECTIVE</td>
<td><strong>systemd.t.CAP_EFFECTIVE</strong> represents the capabilities of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.CMDLINE</td>
<td><strong>systemd.t.CMDLINE</strong> is the command line of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.COMM</td>
<td><strong>systemd.t.COMM</strong> is the name of the journal entry process.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>systemd.t.EXE</td>
<td><strong>systemd.t.EXE</strong> is the executable path of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.GID</td>
<td><strong>systemd.t.GID</strong> is the group ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.HOSTNAME</td>
<td><strong>systemd.t.HOSTNAME</strong> is the name of the host.</td>
</tr>
<tr>
<td>systemd.t.MACHINE_ID</td>
<td><strong>systemd.t.MACHINE_ID</strong> is the machine ID of the host.</td>
</tr>
<tr>
<td>systemd.t.PID</td>
<td><strong>systemd.t.PID</strong> is the process ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SELINUX_CONTEXT</td>
<td><strong>systemd.t.SELINUX_CONTEXT</strong> is the security context, or label, for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SOURCE_REALTIME_TIMESTAMP</td>
<td><strong>systemd.t.SOURCE_REALTIME_TIMESTAMP</strong> is the earliest and most reliable timestamp of the message. This is converted to RFC 3339 NS format.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_CGROUP</td>
<td><strong>systemd.t.SYSTEMD_CGROUP</strong> is the systemd control group path.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_OWNER_UID</td>
<td><strong>systemd.t.SYSTEMD_OWNER_UID</strong> is the owner ID of the session.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_SESSION</td>
<td><strong>systemd.t.SYSTEMD_SESSION</strong>, if applicable, is the systemd session ID.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_SLICE</td>
<td><strong>systemd.t.SYSTEMD_SLICE</strong> is the slice unit of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_UNIT</td>
<td><strong>systemd.t.SYSTEMD_UNIT</strong> is the unit name for a session.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_USER_UNIT</td>
<td><strong>systemd.t.SYSTEMD_USER_UNIT</strong>, if applicable, is the user unit name for a session.</td>
</tr>
<tr>
<td>systemd.t.TRANSPORT</td>
<td><strong>systemd.t.TRANSPORT</strong> is the method of entry by the journal service. This includes, <strong>audit</strong>, <strong>driver</strong>, <strong>syslog</strong>, <strong>journal</strong>, <strong>stdout</strong>, and <strong>kernel</strong>.</td>
</tr>
<tr>
<td>systemd.t.UID</td>
<td><strong>systemd.t.UID</strong> is the user ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SYSLOG_FACILITY</td>
<td><strong>systemd.t.SYSLOG_FACILITY</strong> is the field containing the facility, formatted as a decimal string, for syslog.</td>
</tr>
<tr>
<td>systemd.t.SYSLOG_IDENTIFIER</td>
<td><strong>systemd.t.SYSLOG_IDENTIFIER</strong> is the identifier for syslog.</td>
</tr>
</tbody>
</table>
### systemd.t Fields

`SYSLOG_PID` is the client process ID for `syslog`.

### systemd.u Fields

`systemd.u` Fields are directly passed from clients and stored in the journal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>systemd.u.CODE_FILE</code></td>
<td><code>systemd.u.CODE_FILE</code> is the code location containing the filename of the source.</td>
</tr>
<tr>
<td><code>systemd.u.CODE_FUNCTION</code></td>
<td><code>systemd.u.CODE_FUNCTION</code> is the code location containing the function of the source.</td>
</tr>
<tr>
<td><code>systemd.u.CODE_LINE</code></td>
<td><code>systemd.u.CODE_LINE</code> is the code location containing the line number of the source.</td>
</tr>
<tr>
<td><code>systemd.u.ERRNO</code></td>
<td><code>systemd.u.ERRNO</code>, if present, is the low-level error number formatted in numeric value, as a decimal string.</td>
</tr>
<tr>
<td><code>systemd.u.MESSAGE_ID</code></td>
<td><code>systemd.u.MESSAGE_ID</code> is the message identifier ID for recognizing message types.</td>
</tr>
<tr>
<td><code>systemd.u.RESULT</code></td>
<td>For private use only.</td>
</tr>
<tr>
<td><code>systemd.u.UNIT</code></td>
<td>For private use only.</td>
</tr>
</tbody>
</table>

### 14.3. KUBERNETES EXPORTED FIELDS

These are the Kubernetes fields exported by the OpenShift Container Platform cluster logging available for searching from Elasticsearch and Kibana.

The namespace for Kubernetes-specific metadata. The `kubernetes.pod_name` is the name of the pod.

#### kubernetes.labels Fields

Labels attached to the OpenShift object are `kubernetes.labels`. Each label name is a subfield of labels field. Each label name is de-dotted, meaning dots in the name are replaced with underscores.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>kubernetes.pod_id</code></td>
<td>Kubernetes ID of the pod.</td>
</tr>
<tr>
<td><code>kubernetes.namespace_name</code></td>
<td>The name of the namespace in Kubernetes.</td>
</tr>
<tr>
<td><code>kubernetes.namespace_id</code></td>
<td>ID of the namespace in Kubernetes.</td>
</tr>
</tbody>
</table>
### Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kubernetes.host</td>
<td>Kubernetes node name.</td>
</tr>
<tr>
<td>kubernetes.container_name</td>
<td>The name of the container in Kubernetes.</td>
</tr>
<tr>
<td>kubernetes.labels.deployment</td>
<td>The deployment associated with the Kubernetes object.</td>
</tr>
<tr>
<td>kubernetes.labels.deploymentconfig</td>
<td>The deploymentconfig associated with the Kubernetes object.</td>
</tr>
<tr>
<td>kubernetes.labels.component</td>
<td>The component associated with the Kubernetes object.</td>
</tr>
<tr>
<td>kubernetes.labels.provider</td>
<td>The provider associated with the Kubernetes object.</td>
</tr>
</tbody>
</table>

**kubernetes.annotations** Fields
Annotations associated with the OpenShift object are `kubernetes.annotations` fields.

### 14.4. CONTAINER EXPORTED FIELDS

These are the Docker fields exported by the OpenShift Container Platform cluster logging available for searching from Elasticsearch and Kibana. Namespace for docker container-specific metadata. The docker.container_id is the Docker container ID.

**pipeline_metadata.collector** Fields
This section contains metadata specific to the collector.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pipeline_metadata.collector.hostname</td>
<td>FQDN of the collector. It might be different from the FQDN of the actual emitter of the logs.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.name</td>
<td>Name of the collector.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.version</td>
<td>Version of the collector.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.ipaddr4</td>
<td>IP address v4 of the collector server, can be an array.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.ipaddr6</td>
<td>IP address v6 of the collector server, can be an array.</td>
</tr>
</tbody>
</table>
### Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pipeline_metadata.collector.inputname</td>
<td>How the log message was received by the collector whether it was TCP/UDP, or imjournal/imfile.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.received_at</td>
<td>Time when the message was received by the collector.</td>
</tr>
<tr>
<td>pipeline_metadata.collector.original_raw_message</td>
<td>The original non-parsed log message, collected by the collector or as close to the source as possible.</td>
</tr>
</tbody>
</table>

**pipeline_metadata.normalizer Fields**

This section contains metadata specific to the normalizer.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pipeline_metadata.normalizer.hostname</td>
<td>FQDN of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.name</td>
<td>Name of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.version</td>
<td>Version of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.ipaddr4</td>
<td>IP address v4 of the normalizer server, can be an array.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.ipaddr6</td>
<td>IP address v6 of the normalizer server, can be an array.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.inputname</td>
<td>how the log message was received by the normalizer whether it was TCP/UDP.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.received_at</td>
<td>Time when the message was received by the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normalizer.original_raw_message</td>
<td>The original non-parsed log message as it is received by the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.trace</td>
<td>The field records the trace of the message. Each collector and normalizer appends information about itself and the date and time when the message was processed.</td>
</tr>
</tbody>
</table>

14.5. OVIRT EXPORTED FIELDS
These are the oVirt fields exported by the OpenShift Container Platform cluster logging available for searching from Elasticsearch and Kibana.

Namespace for oVirt metadata.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ovirt.entity</td>
<td>The type of the data source, hosts, VMS, and engine.</td>
</tr>
<tr>
<td>ovirt.host_id</td>
<td>The oVirt host UUID.</td>
</tr>
</tbody>
</table>

ovirt.engine Fields
Namespace for oVirt engine related metadata. The FQDN of the oVirt engine is ovirt.engine.fqdn

14.6. AUSHAPE EXPORTED FIELDS

These are the Aushape fields exported by the OpenShift Container Platform cluster logging available for searching from Elasticsearch and Kibana.

Audit events converted with Aushape. For more information, see Aushape.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aushape.serial</td>
<td>Audit event serial number.</td>
</tr>
<tr>
<td>aushape.node</td>
<td>Name of the host where the audit event occurred.</td>
</tr>
<tr>
<td>aushape.error</td>
<td>The error aushape encountered while converting the event.</td>
</tr>
<tr>
<td>aushape.trimmed</td>
<td>An array of JSONPath expressions relative to the event object, specifying objects or arrays with the content removed as the result of event size limiting. An empty string means the event removed the content, and an empty array means the trimming occurred by unspecified objects and arrays.</td>
</tr>
<tr>
<td>aushape.text</td>
<td>An array log record strings representing the original audit event.</td>
</tr>
</tbody>
</table>

aushape.data Fields
Parsed audit event data related to Aushape.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aushape.data.avc</td>
<td>type: nested</td>
</tr>
<tr>
<td>aushape.data.execve</td>
<td>type: string</td>
</tr>
<tr>
<td>aushape.data.netfilter_cfg</td>
<td>type: nested</td>
</tr>
</tbody>
</table>
14.7. TLOG EXPORTED FIELDS

These are the Tlog fields exported by the OpenShift Container Platform cluster logging system and available for searching from Elasticsearch and Kibana.

Tlog terminal I/O recording messages. For more information see Tlog.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aushape.data.obj_pid</td>
<td>type: nested</td>
</tr>
<tr>
<td>aushape.data.path</td>
<td>type: nested</td>
</tr>
<tr>
<td>tlog.ver</td>
<td>Message format version number.</td>
</tr>
<tr>
<td>tlog.user</td>
<td>Recorded user name.</td>
</tr>
<tr>
<td>tlog.term</td>
<td>Terminal type name.</td>
</tr>
<tr>
<td>tlog.session</td>
<td>Audit session ID of the recorded session.</td>
</tr>
<tr>
<td>tlog.id</td>
<td>ID of the message within the session.</td>
</tr>
<tr>
<td>tlog.pos</td>
<td>Message position in the session, milliseconds.</td>
</tr>
<tr>
<td>tlog.timing</td>
<td>Distribution of this message’s events in time.</td>
</tr>
<tr>
<td>tlog.in_txt</td>
<td>Input text with invalid characters scrubbed.</td>
</tr>
<tr>
<td>tlog.in_bin</td>
<td>Scrubbed invalid input characters as bytes.</td>
</tr>
<tr>
<td>tlog.out_txt</td>
<td>Output text with invalid characters scrubbed.</td>
</tr>
<tr>
<td>tlog.out_bin</td>
<td>Scrubbed invalid output characters as bytes.</td>
</tr>
</tbody>
</table>
CHAPTER 15. UNINSTALLING CLUSTER LOGGING

You can remove cluster logging from your OpenShift Container Platform cluster.

15.1. UNINSTALLING CLUSTER LOGGING FROM OPENSHIFT CONTAINER PLATFORM

You can remove cluster logging from your cluster.

Prerequisites

- Cluster logging and Elasticsearch must be installed.

Procedure

To remove cluster logging:

1. Use the following command to remove everything generated during the deployment.

   $ oc delete clusterlogging instance -n openshift-logging

2. Use the following command to remove the Persistent Volume Claims that remain after the Operator instances are deleted:

   $ oc delete pvc --all -n openshift-logging