OpenShift Container Platform 4.7

Logging

OpenShift Logging installation, usage, and release notes
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Abstract

This document provides instructions for installing, configuring, and using OpenShift Logging, which aggregates logs for a range of OpenShift Container Platform services.
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CHAPTER 1. RELEASE NOTES FOR RED HAT OPENSHIFT LOGGING 5.0

1.1. ABOUT THIS RELEASE

The following advisories are available for Red Hat OpenShift Logging 5.0:

- RHBA-2021:0652 Bug Fix Advisory for OpenShift Logging 5.0.0
- RHBA-2021:0963 Bug Fix Advisory for OpenShift Logging Bug Fix Release (5.0.1)
- RHBA-2021:1167 Bug Fix Advisory for OpenShift Logging Bug Fix Release (5.0.2)
- RHSA-2021:1515 Security Advisory for Important OpenShift Logging Bug Fix Release (5.0.3)

1.2. MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see Red Hat CTO Chris Wright’s message.

1.3. DEPRECATED AND REMOVED FEATURES

Some features available in previous releases have been deprecated or removed.

Deprecated functionality is still included in OpenShift Logging and continues to be supported; however, it will be removed in a future release of this product and is not recommended for new deployments.

1.3.1. Elasticsearch Curator

The Elasticsearch Curator is deprecated in OpenShift Logging 5.0 and will be removed in OpenShift Logging 5.1. Elasticsearch Curator helps you curate or manage your indices on OpenShift Container Platform 4.4 and earlier. Instead of using Elasticsearch Curator, configure the log retention time.

1.4. OPENSHPIFT LOGGING 5.0.0

This release includes RHBA-2021:0652 Bug Fix Advisory for OpenShift Logging 5.0.0.

1.4.1. New features and enhancements

This release adds improvements related to the following concepts.

Cluster Logging becomes Red Hat OpenShift Logging
With this release, Cluster Logging becomes Red Hat OpenShift Logging, version 5.0.

Maximum five primary shards per index
With this release, the OpenShift Elasticsearch Operator (EO) sets the number of primary shards for an index between one and five, depending on the number of data nodes defined for a cluster.

Previously, the EO set the number of shards for an index to the number of data nodes. When an index in Elasticsearch was configured with a number of replicas, it created that many replicas for each primary shard, not per index. Therefore, as the index sharded, a greater number of replica shards existed in the
cluster, which created a lot of overhead for the cluster to replicate and keep in sync.

Updated OpenShift Elasticsearch Operator name and maturity level
This release updates the display name of the OpenShift Elasticsearch Operator and operator maturity level. The new display name and clarified specific use for the OpenShift Elasticsearch Operator are updated in Operator Hub.

OpenShift Elasticsearch Operator reports on CSV success
This release adds reporting metrics to indicate that installing or upgrading the `ClusterServiceVersion` (CSV) object for the OpenShift Elasticsearch Operator was successful. Previously, there was no way to determine, or generate an alert, if the installing or upgrading the CSV failed. Now, an alert is provided as part of the OpenShift Elasticsearch Operator.

Reduce Elasticsearch pod certificate permission warnings
Previously, when the Elasticsearch pod started, it generated certificate permission warnings, which misled some users to troubleshoot their clusters. The current release fixes these permissions issues to reduce these types of notifications.

New links from alerts to explanations and troubleshooting
This release adds a link from the alerts that an Elasticsearch cluster generates to a page of explanations and troubleshooting steps for that alert.

New connection timeout for deletion jobs
The current release adds a connection timeout for deletion jobs, which helps prevent pods from occasionally hanging when they query Elasticsearch to delete indices. Now, if the underlying ‘curl’ call does not connect before the timeout period elapses, the timeout terminates the call.

Minimize updates to rollover index templates
With this enhancement, the OpenShift Elasticsearch Operator only updates its rollover index templates if they have different field values. Index templates have a higher priority than indices. When the template is updated, the cluster prioritizes distributing them over the index shards, impacting performance. To minimize Elasticsearch cluster operations, the operator only updates the templates when the number of primary shards or replica shards changes from what is currently configured.

1.4.2. Technology Preview features
Some features in this release are currently in Technology Preview. These experimental features are not intended for production use. Note the following scope of support on the Red Hat Customer Portal for these features:

Technology Preview Features Support Scope

In the table below, features are marked with the following statuses:

- **TP**: Technology Preview
- **GA**: General Availability
- **-**: Not Available

Table 1.1. Technology Preview tracker

<table>
<thead>
<tr>
<th>Feature</th>
<th>OCP 4.5</th>
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1.4.3. Bug fixes

- Previously, Elasticsearch rejected HTTP requests whose headers exceeded the default max header size, 8 KB. Now, the max header size is 128 KB, and Elasticsearch no longer rejects HTTP requests for exceeding the max header size. (BZ#1845293)

- Previously, nodes did not recover from Pending status because a software bug did not correctly update their statuses in the Elasticsearch custom resource (CR). The current release fixes this issue, so the nodes can recover when their status is Pending. (BZ#1887357)

- Previously, when the Cluster Logging Operator (CLO) scaled down the number of Elasticsearch nodes in the clusterlogging CR to three nodes, it omitted previously-created nodes that had unique IDs. The OpenShift Elasticsearch Operator rejected the update because it has safeguards that prevent nodes with unique IDs from being removed. Now, when the CLO scales down the number of nodes and updates the Elasticsearch CR, it marks nodes with unique IDs as count 0 instead of omitting them. As a result, users can scale down their cluster to 3 nodes by using the clusterlogging CR. (BZ#1879150)

- Previously, the Fluentd collector pod went into a crash loop when the ClusterLogForwarder had an incorrectly-configured secret. The current release fixes this issue. Now, the ClusterLogForwarder validates the secrets and reports any errors in its status field. As a result, it does not cause the Fluentd collector pod to crash. (1888943)

- Previously, if you updated the Kibana resource configuration in the clusterlogging instance to resource{}, the resulting nil map caused a panic and changed the status of the OpenShift Elasticsearch Operator to CrashLoopBackOff. The current release fixes this issue by initializing the map. (BZ#1889573)

- Previously, the fluentd collector pod went into a crash loop when the ClusterLogForwarder had multiple outputs using the same secret. The current release fixes this issue. Now, multiple outputs can share a secret. (1890072)

- Previously, if you deleted a Kibana route, the Cluster Logging Operator (CLO) could not recover or recreate it. Now, the CLO watches the route, and if you delete the route, the OpenShift Elasticsearch Operator can reconcile or recreate it. (BZ#1890825)

- Previously, the Cluster Logging Operator (CLO) would attempt to reconcile the Elasticsearch resource, which depended upon the Red Hat-provided Elastic Custom Resource Definition (CRD). Attempts to list an unknown kind caused the CLO to exit its reconciliation loop. This happened because the CLO tried to reconcile all of its managed resources whether they were defined or not. The current release fixes this issue. The CLO only reconciles types provided by the OpenShift Elasticsearch Operator if a user defines managed storage. As a result, users can create collector-only deployments of cluster logging by deploying the CLO. (BZ#1891738)

- Previously, because of an LF GA syslog implementation for RFC 3164, logs sent to remote syslog were not compatible with the legacy behavior. The current release fixes this issue. AddLogSource adds details about log’s source details to the “message” field. Now, logs sent to remote syslog are compatible with the legacy behavior. (BZ#1891886)

- Previously, the Elasticsearch rollover pods failed with a resource_already_exists_exception
error. Within the Elasticsearch rollover API, when the next index was created, the *-write alias was not updated to point to it. As a result, the next time the rollover API endpoint was triggered for that particular index, it received an error that the resource already existed. The current release fixes this issue. Now, when a rollover occurs in the indexmanagement cronjobs, if a new index was created, it verifies that the alias points to the new index. This behavior prevents the error. If the cluster is already receiving this error, a cronjob fixes the issue so that subsequent runs work as expected. Now, performing rollovers no longer produces the exception. (BZ#1893992)

- Previously, Fluent stopped sending logs even though the logging stack seemed functional. Logs were not shipped to an endpoint for an extended period even when an endpoint came back up. This happened if the max backoff time was too long and the endpoint was down. The current release fixes this issue by lowering the max backoff time, so the logs are shipped sooner. (BZ#1894634)

- Previously, omitting the Storage size of the Elasticsearch node caused panic in the OpenShift Elasticsearch Operator code. This panic appeared in the logs as: Observed a panic: "invalid memory address or nil pointer dereference". The panic happened because although Storage size is a required field, the software didn’t check for it. The current release fixes this issue, so there is no panic if the storage size is omitted. Instead, the storage defaults to ephemeral storage and generates a log message for the user. (BZ#1899589)

- Previously, elasticsearch-rollover and elasticsearch-delete pods remained in the Invalid JSON: or ValueError: No JSON object could be decoded error states. This exception was raised because there was no exception handler for invalid JSON input. The current release fixes this issue by providing a handler for invalid JSON input. As a result, the handler outputs an error message instead of an exception traceback, and the elasticsearch-rollover and elasticsearch-delete jobs do not remain those error states. (BZ#1899905)

- Previously, when deploying Fluentd as a stand-alone, a Kibana pod was created even if the value of replicas was 0. This happened because Kibana defaulted to 1 pod even when there were no Elasticsearch nodes. The current release fixes this. Now, a Kibana only defaults to 1 when there are one or more Elasticsearch nodes. (BZ#1901424)

- Previously, if you deleted the secret, it was not recreated. Even though the certificates were on a disk local to the operator, they weren’t rewritten because they hadn’t changed. That is, certificates were only written if they changed. The current release fixes this issue. It rewrites the secret if the certificate changes or is not found. Now, if you delete the master-certs, they are replaced. (BZ#1901869)

- Previously, if a cluster had multiple custom resources with the same name, the resource would get selected alphabetically when not fully qualified with the API group. As a result, if you installed both Red Hat’s OpenShift Elasticsearch Operator alongside the OpenShift Elasticsearch Operator, you would see failures when collected data via a must-gather report. The current release fixes this issue by ensuring must-gathers now use the full API group when gathering information about the cluster’s custom resources. (BZ#1897731)

- An earlier bug fix to address issues related to certificate generation introduced an error. Trying to read the certificates caused them to be regenerated because they were recognized as missing. This, in turn, triggered the OpenShift Elasticsearch Operator to perform a rolling upgrade on the Elasticsearch cluster and, potentially, to have mismatched certificates. This bug was caused by the operator incorrectly writing certificates to the working directory. The current release fixes this issue. Now the operator consistently reads and writes certificates to the same working directory, and the certificates are only regenerated if needed. (BZ#1905910)

- Previously, queries to the root endpoint to retrieve the Elasticsearch version received a 403 response. The 403 response broke any services that used this endpoint in prior releases. This
error happened because non-administrative users did not have the `monitor` permission required to query the root endpoint and retrieve the Elasticsearch version. Now, non-administrative users can query the root endpoint for the deployed version of Elasticsearch. (BZ#1906765)

- Previously, in some bulk insertion situations, the Elasticsearch proxy timed out connections between fluentd and Elasticsearch. As a result, fluentd failed to deliver messages and logged a **Server returned nothing (no headers, no data)** error. The current release fixes this issue: It increases the default HTTP read and write timeouts in the Elasticsearch proxy from five seconds to one minute. It also provides command-line options in the Elasticsearch proxy to control HTTP timeouts in the field. (BZ#1908707)

- Previously, in some cases, the Red Hat OpenShift Logging/Elasticsearch dashboard was missing from the OpenShift Container Platform monitoring dashboard because the dashboard configuration resource referred to a different namespace owner and caused the OpenShift Container Platform to garbage-collect that resource. Now, the ownership reference is removed from the OpenShift Elasticsearch Operator reconciler configuration, and the logging dashboard appears in the console. (BZ#1910259)

- Previously, the code that uses environment variables to replace values in the Kibana configuration file did not consider commented lines. This prevented users from overriding the default value of `server.maxPayloadBytes`. The current release fixes this issue by uncommenting the default value of `server.maxPayloadBytes` within. Now, users can override the value by using environment variables, as documented. (BZ#1918876)

- Previously, the Kibana log level was increased not to suppress instructions to delete indices that failed to migrate, which also caused the display of GET requests at the INFO level that contained the Kibana user’s email address and OAuth token. The current release fixes this issue by masking these fields, so the Kibana logs do not display them. (BZ#1925081)

1.4.4. Known issues

- Fluentd pods with the `ruby-kafka-1.1.0` and `fluent-plugin-kafka-0.13.1` gems are not compatible with Apache Kafka version 0.10.1.0. As a result, log forwarding to Kafka fails with a message: 

  ```
  error_class=Kafka::DeliveryFailed
  error="Failed to send messages to flux-openshift-v4/1"
  ```

  The `ruby-kafka-0.7` gem dropped support for Kafka 0.10 in favor of native support for Kafka 0.11. The `ruby-kafka-1.0.0` gem added support for Kafka 2.3 and 2.4. The current version of OpenShift Logging tests and therefore supports Kafka version 2.4.1.

  To work around this issue, upgrade to a supported version of Apache Kafka. (BZ#1907370)

1.5. OPENS Shift LOGGING 5.0.1

This release includes RHBA-2021:0963 Bug Fix Advisory for OpenShift Logging Bug Fix Release (5.0.1).

1.5.1. Bug fixes

- Previously, if you enabled legacy log forwarding, logs were not sent to managed storage. This issue occurred because the generated log forwarding configuration improperly chose between either log forwarding or legacy log forwarding. The current release fixes this issue. If the
**ClusterLogging** CR defines a **logstore**, logs are sent to managed storage. Additionally, if legacy log forwarding is enabled, logs are sent to legacy log forwarding regardless of whether managed storage is enabled. (LOG-1172)

- Previously, while under load, Elasticsearch responded to some requests with an HTTP 500 error, even though there was nothing wrong with the cluster. Retrying the request was successful. This release fixes the issue by updating the cron jobs to be more resilient when encountering temporary HTTP 500 errors. Now, they will retry a request multiple times first before failing. (LOG-1215)

1.6. OPENSHIFT LOGGING 5.0.2

This release includes RHBA-2021:1167 Bug Fix Advisory for OpenShift Logging Bug Fix Release (5.0.2).

1.6.1. Bug fixes

- If you did not set `.proxy` in the cluster installation configuration, and then configured a global proxy on the installed cluster, a bug prevented Fluentd from forwarding logs to Elasticsearch. To work around this issue, in the proxy/cluster configuration, set `no_proxy` to `.svc.cluster.local` so it skips internal traffic. The current release fixes the proxy configuration issue. Now, if you configure the global proxy after installing an OpenShift cluster, Fluentd forwards logs to Elasticsearch. (LOG-1187)

- Previously, forwarding logs to Kafka using chained certificates failed with error "state=error: certificate verify failed (unable to get local issuer certificate)." Logs could not be forwarded to a Kafka broker with a certificate signed by an intermediate CA. This happened because fluentd Kafka plugin could only handle a single CA certificate supplied in the ca-bundle.crt entry of the corresponding secret. The current release fixes this issue by enabling the fluentd Kafka plugin to handle multiple CA certificates supplied in the ca-bundle.crt entry of the corresponding secret. Now, logs can be forwarded to a Kafka broker with a certificate signed by an intermediate CA. (LOG-1216, LOG-1218)

- Previously, an update in the cluster service version (CSV) accidentally introduced resources and limits for the OpenShift Elasticsearch operator container. Under specific conditions, this caused an out-of-memory condition that terminated the Elasticsearch operator pod. The current release fixes this issue by removing the CSV resources and limits for the operator container. Now, the operator gets scheduled without issues. (LOG-1254)

1.7. OPENSHIFT LOGGING 5.0.3

This release includes RHSA-2021:1515 Security Advisory for Important OpenShift Logging Bug Fix Release (5.0.3)

1.7.1. Security fixes

- jackson-databind: arbitrary code execution in slf4j-ext class (CVE-2018-14718)


- jackson-databind: exfiltration/XXE in some JDK classes (CVE-2018-14720)

- jackson-databind: server-side request forgery (SSRF) in axis2-jaxws class (CVE-2018-14721)
- jackson-databind: improper polymorphic deserialization in axis2-transport-jms class (CVE-2018-19360)
- jackson-databind: improper polymorphic deserialization in openjpa class (CVE-2018-19361)
- jackson-databind: improper polymorphic deserialization in jboss-common-core class (CVE-2018-19362)
- jackson-databind: default typing mishandling leading to remote code execution (CVE-2019-14379)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.commons.dbcp2.datasources.PerUserPoolDataSource (CVE-2020-35490)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.commons.dbcp2.datasources.SharedPoolDataSource (CVE-2020-35491)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to com.oracle.wls.shaded.org.apache.xalan.lib.sql.JNDIConnectionPool (CVE-2020-35728)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to oadd.org.apache.commons.dbcp.cpdsadapter.DriverAdapterCPDS (CVE-2020-36179)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.commons.dbcp2.cpdsadapter.DriverAdapterCPDS (CVE-2020-36180)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp.cpdsadapter.DriverAdapterCPDS (CVE-2020-36181)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp2.cpdsadapter.DriverAdapterCPDS (CVE-2020-36182)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.docx4j.org.apache.xalan.lib.sql.JNDIConnectionPool (CVE-2020-36183)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp2.datasources.PerUserPoolDataSource (CVE-2020-36184)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp2.datasources.SharedPoolDataSource (CVE-2020-36185)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp2.datasources.PerUserPoolDataSource (CVE-2020-36186)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to org.apache.tomcat.dbcp.dbcp2.datasources.SharedPoolDataSource (CVE-2020-36187)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to com.newrelic.agent.deps.ch.qos.logback.core.db.JNDIConnectionSource (CVE-2020-36188)
- jackson-databind: mishandles the interaction between serialization gadgets and typing, related to com.newrelic.agent.deps.ch.qos.logback.core.db.DriverManagerConnectionSource (CVE-2020-36189)
• jackson-databind: mishandles the interaction between serialization gadgets and typing, related to javax.swing (CVE-2021-20190)

• golang: data race in certain net/http servers including ReverseProxy can lead to DoS (CVE-2020-15586)

• golang: ReadUvarint and ReadVarint can read an unlimited number of bytes from invalid inputs (CVE-2020-16845)

• OpenJDK: Incomplete enforcement of JAR signing disabled algorithms (Libraries, 8249906) (CVE-2021-2163)

The following Jira issues contain the above CVEs:

• LOG-1234 CVE-2020-15586 CVE-2020-16845 openshift-eventrouter: various flaws [openshift-4]. (LOG-1234)


1.7.2. Bug fixes

This release also includes the following bug fixes:

• LOG-1224 Release 5.0 - ClusterLogForwarder namespace-specific log forwarding does not work as expected. (LOG-1224)

• LOG-1232 5.0 - Bug 1859004 - Sometimes the eventrouter couldn’t gather event logs. (LOG-1232)

• LOG-1299 Release 5.0 - Forwarding logs to Kafka using Chained certificates fails with error "state=error: certificate verify failed (unable to get local issuer certificate)." (LOG-1299)
CHAPTER 2. UNDERSTANDING RED HAT OPENS.HIFT LOGGING

As a cluster administrator, you can deploy OpenShift Logging to aggregate all the logs from your OpenShift Container Platform cluster, such as node system audit logs, application container logs, and infrastructure logs. OpenShift Logging aggregates these logs from throughout your cluster and stores them in a default log store. You can use the Kibana web console to visualize log data.

OpenShift Logging aggregates the following types of logs:

- **application** - Container logs generated by user applications running in the cluster, except infrastructure container applications.
- **infrastructure** - Logs generated by 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.
- **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**

Because the internal OpenShift Container Platform Elasticsearch log store does not provide secure storage for audit logs, audit logs are not stored in the internal Elasticsearch instance by default. If you want to send the audit logs to the internal log store, for example to view the audit logs in Kibana, you must use the Log Forwarding API as described in Forward audit logs to the log store.

2.1. ABOUT DEPLOYING OPENS.HIFT LOGGING

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

The ClusterLogging CR defines a complete OpenShift Logging environment that includes all the components of the logging stack to collect, store and visualize logs. The Cluster Logging Operator watches the OpenShift Logging CR and adjusts the logging deployment accordingly.

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

For information, see Configuring the log collector.

2.1.1. About OpenShift Logging components

The OpenShift Logging components include a collector deployed to each node in the OpenShift Container Platform cluster that collects all node and container logs and writes them to a log store. You can use a centralized web UI to create rich visualizations and dashboards with the aggregated data.

The major components of OpenShift Logging are:
collection - This is the component that collects logs from the cluster, formats them, and forwards them to the log store. The current implementation is Fluentd.

log store - This is where the logs are stored. The default implementation is Elasticsearch. You can use the default Elasticsearch log store or forward logs to external log stores. The default log store is optimized and tested for short-term storage.

visualization - This is the UI component you can use to view logs, graphs, charts, and so forth. The current implementation is Kibana.

This document might refer to log store or Elasticsearch, visualization or Kibana, collection or Fluentd, interchangeably, except where noted.

2.1.2. About the logging collector

OpenShift Container Platform uses Fluentd to collect container and node logs.

By default, the log collector uses the following sources:

- journald for all system logs
- /var/log/containers/*.log for all container logs

If you configure the log collector to collect audit logs, it gets them from /var/log/audit/audit.log.

The logging collector is a daemon set that deploys pods to each OpenShift Container Platform node. System and infrastructure logs are generated by journald log messages from the operating system, the container runtime, and OpenShift Container Platform. Application logs are generated by the CRI-O container engine. Fluentd collects the logs from these sources and forwards them internally or externally as you configure in OpenShift Container Platform.

The container runtimes provide minimal information to identify the source of log messages: project, pod name, and container ID. This information 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 that log collection and normalization are 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 information, see Configuring the log collector.

2.1.3. About the log store

By default, OpenShift Container Platform uses Elasticsearch (ES) to store log data. Optionally, you can use the log forwarding features to forward logs to external log stores using Fluentd protocols, syslog protocols, or the OpenShift Container Platform Log Forwarding API.

The OpenShift Logging Elasticsearch instance is optimized and tested for short term storage, approximately seven days. If you want to retain your logs over a longer term, it is recommended you move the data to a third-party storage system.
Elasticsearch organizes the log data from Fluentd into datastores, or indices, then 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, which Elasticsearch also spreads across the Elasticsearch nodes. The ClusterLogging custom resource (CR) allows you to specify how the shards are replicated to provide data redundancy and resilience to failure. You can also specify how long the different types of logs are retained using a retention policy in the ClusterLogging CR.

**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 OpenShift Elasticsearch Operator ensure that each Elasticsearch node is deployed using a unique deployment that includes its own storage volume. You can use a ClusterLogging custom resource (CR) to increase the number of Elasticsearch nodes, as needed. Refer to the Elasticsearch documentation for considerations involved in configuring storage.

**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. Administrators can access all logs and developers can access only the logs in their projects.

For information, see Configuring the log store.

### 2.1.4. 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, and other visualizations.

For information, see Configuring the log visualizer.

### 2.1.5. About event routing

The Event Router is a pod that watches OpenShift Container Platform events so they can be collected by OpenShift Logging. The Event Router collects events from all projects and writes them to STDOUT. Fluentd collects those events and forwards them into the OpenShift Container Platform Elasticsearch instance. Elasticsearch indexes the events to the infra index.

You must manually deploy the Event Router.

For information, see Collecting and storing Kubernetes events.

### 2.1.6. About log forwarding

...
By default, OpenShift Logging sends logs to the default internal Elasticsearch log store, defined in the `ClusterLogging` custom resource (CR). If you want to forward logs to other log aggregators, you can use the log forwarding features to send logs to specific endpoints within or outside your cluster.

For information, see Forwarding logs to third party systems.
CHAPTER 3. INSTALLING OPENSSHIFT LOGGING

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

The process for deploying OpenShift Logging to OpenShift Container Platform involves:

- Reviewing the OpenShift Logging storage considerations.
- Installing the OpenShift Elasticsearch Operator and Cluster Logging Operator using the OpenShift Container Platform web console or CLI.

3.1. INSTALLING OPENSHEREF LOGGING USING THE WEB CONSOLE

You can use the OpenShift Container Platform web console to install the OpenShift Elasticsearch and Cluster Logging Operators.

Prerequisites

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

**NOTE**

If you use a local volume for persistent storage, do not use a raw block volume, which is described with `volumeMode: block` in the `LocalVolume` object. Elasticsearch cannot use raw block volumes.

Elasticsearch is a memory-intensive application. By default, OpenShift Container Platform installs three Elasticsearch nodes with memory requests and limits of 16 GB. This initial set of three OpenShift Container Platform nodes might not have enough memory to run Elasticsearch within your cluster. If you experience memory issues that are related to Elasticsearch, add more Elasticsearch nodes to your cluster rather than increasing the memory on existing nodes.

Procedure

To install the OpenShift Elasticsearch Operator and Cluster Logging Operator using the OpenShift Container Platform web console:

1. Install the OpenShift Elasticsearch Operator:
   a. In the OpenShift Container Platform web console, click **Operators** → **OperatorHub**.
   b. Choose **OpenShift Elasticsearch Operator** from the list of available Operators, and click **Install**.
   c. Ensure that the **All namespaces on the cluster** is selected under **Installation Mode**.
   d. Ensure that openshift-operators-redhat is selected under **Installed Namespace**. You must specify the openshift-operators-redhat 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.
2. Install the Cluster Logging Operator:
   b. Choose Cluster Logging from the list of available Operators, and click Install.
   c. Ensure that the A specific namespace on the cluster is selected under Installation Mode.
   d. Ensure that Operator recommended namespace is openshift-logging under Installed Namespace.
   e. Select Enable operator recommended cluster monitoring on this namespace
      This option sets the openshift.io/cluster-monitoring: "true" label in the Namespace object. You must select this option to ensure that cluster monitoring scrapes the openshift-logging namespace.
   f. Select 5.0 as the Update Channel
   g. Select an Approval Strategy.
      - The Automatic strategy allows Operator Lifecycle Manager (OLM) to automatically update the Operator when a new version is available.
      - The Manual strategy requires a user with appropriate credentials to approve the Operator update.
   h. Click Install.
   i. Verify that the Cluster Logging Operator installed by switching to the Operators → Installed Operators page.
   j. Ensure that Cluster Logging is listed in the openshift-logging project with a Status of Succeeded.
      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** project that are reporting issues.

3. Create a OpenShift Logging instance:

   a. Switch to the **Administration → Custom Resource Definitions** page.

   b. On the **Custom Resource Definitions** page, click **ClusterLogging**.

   c. On the **Custom Resource Definition Overview** page, select **View Instances** from the **Actions** menu.

   d. On the **ClusterLoggings** page, click **Create ClusterLogging**. 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"  
     namespace: "openshift-logging"
   spec:
     managementState: "Managed"  
     logStore:
       type: "elasticsearch"  
       retentionPolicy:
         application:
           maxAge: 1d
           infra:
           maxAge: 7d
         audit:
           maxAge: 7d
       elasticsearch:
       nodeCount: 3  
       storage:
       storageClassName: "<storage_class_name>"  
       size: 200G
   resources:
   requests:
     memory: "8Gi"
   proxy:
   resources:
   limits:
   ```

   **NOTE**

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

The OpenShift Logging management state. In some cases, if you change the OpenShift Logging defaults, you must set this to Unmanaged. However, an unmanaged deployment does not receive updates until OpenShift Logging is placed back into a managed state.

Settings for configuring Elasticsearch. Using the CR, you can configure shard replication policy and persistent storage.

Specify the length of time that Elasticsearch should retain each log source. Enter an integer and a time designation: weeks(w), hours(h/H), minutes(m) and seconds(s). For example, `7d` for seven days. Logs older than the maxAge are deleted. You must specify a retention policy for each log source or the Elasticsearch indices will not be created for that source.

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

Enter the name of an existing storage class for Elasticsearch storage. For best performance, specify a storage class that allocates block storage. If you do not specify a storage class, OpenShift Logging uses ephemeral storage.

Specify the CPU and memory requests for Elasticsearch as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are `16G` for the memory request and `1` for the CPU request.

Specify the CPU and memory requests for the Elasticsearch proxy as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are `256Mi` for the memory request and `100m` for the CPU request.

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 the log visualizer.

Settings for configuring the Curator schedule. Curator is used to remove data that is in the Elasticsearch index format prior to OpenShift Container Platform 4.5 and will be removed in a later release.
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
```

**Example output**

<table>
<thead>
<tr>
<th>Deployment Name</th>
<th>Status</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster-logging-operator</td>
<td>1/1</td>
<td>19h</td>
</tr>
<tr>
<td>elasticsearch-cd-x6kdeki-1</td>
<td>0/1</td>
<td>6m54s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdeki-1</td>
<td>1/1</td>
<td>18h</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdeki-2</td>
<td>0/1</td>
<td>6m49s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdeki-3</td>
<td>0/1</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.

f. Click Create. This creates the OpenShift Logging components, the Elasticsearch custom resource and components, and the Kibana interface.

4. Verify the install:

a. Switch to the Workloads → Pods page.

b. Select the openshift-logging project.

You should see several pods for OpenShift Logging, Elasticsearch, Fluentd, and Kibana similar to the following list:

- cluster-logging-operator-cb795f8dc-xkckc
- elasticsearch-cdm-b3nqzchd-1-5c6797-67kfz
- elasticsearch-cdm-b3nqzchd-2-6657f4-wtprv
- elasticsearch-cdm-b3nqzchd-3-588c65-clg7g
- fluentd-2c7dg
- fluentd-9z7kk
3.2. INSTALLING OPENSHIFT LOGGING USING THE CLI

You can use the OpenShift Container Platform CLI to install the OpenShift Elasticsearch and Cluster Logging Operators.

Prerequisites

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

**NOTE**

If you use a local volume for persistent storage, do not use a raw block volume, which is described with `volumeMode: block` in the `LocalVolume` object. Elasticsearch cannot use raw block volumes.

Elasticsearch is a memory-intensive application. By default, OpenShift Container Platform installs three Elasticsearch nodes with memory requests and limits of 16 GB. This initial set of three OpenShift Container Platform nodes might not have enough memory to run Elasticsearch within your cluster. If you experience memory issues that are related to Elasticsearch, add more Elasticsearch nodes to your cluster rather than increasing the memory on existing nodes.

Procedure

To install the OpenShift Elasticsearch Operator and Cluster Logging Operator using the CLI:

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

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

For example:

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

2. 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"

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

b. Create the Namespace:

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

For example:

```bash
$ oc create -f clo-namespace.yaml
```

3. Install the OpenShift Elasticsearch Operator by creating the following objects:

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

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

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

b. Create an Operator Group object:

```bash
$ 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 the OpenShift Elasticsearch Operator.

**Example Subscription**

```yaml
apiVersion: operators.coreos.com/v1alpha1
group: openshift-operators-redhat
kind: Subscription
metadata:
  name: "elasticsearch-operator"
  namespace: "openshift-operators-redhat"
spec:
  channel: "5.0"
  installPlanApproval: "Automatic"
  source:
    name: "elasticsearch-operator"
    namespace: "openshift-marketplace"
```

1. You must specify the `openshift-operators-redhat` Namespace.
2. Specify `5.0` or `stable` as the channel. `stable` is the latest 5.x released code.
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:

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

For example:

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

The OpenShift Elasticsearch Operator is installed to the `openshift-operators-redhat` Namespace and copied to each project in the cluster.

e. Verify the Operator installation:

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

**Example output**

<table>
<thead>
<tr>
<th>NAMESPACE</th>
<th>NAME</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>default</td>
<td>elasticsearch-operator.5.0.0-202007012112.p0</td>
<td></td>
</tr>
<tr>
<td>OpenShift Elasticsearch Operator</td>
<td>5.0.0-202007012112.p0</td>
<td>Succeeded</td>
</tr>
<tr>
<td>kube-node-lease</td>
<td>elasticsearch-operator.5.0.0-202007012112.p0</td>
<td></td>
</tr>
</tbody>
</table>
4. 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
   $ oc create -f <file-name>.yaml
   $ oc create -f clo-og.yaml
   ```

   You must specify the `openshift-logging` namespace.

   b. Create the OperatorGroup object:

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

   For example:

   ```bash
   $ oc create -f clo-og.yaml
   ```

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

   ```yaml
   apiVersion: operators.coreos.com/v1alpha1
   kind: Subscription
   metadata:
     name: cluster-logging
   namespace: openshift-logging
   spec:
   ```

   There should be an OpenShift Elasticsearch Operator in each Namespace. The version number might be different than shown.
You must specify the `openshift-logging` Namespace.

Specify `5.0` or `stable` as the channel. `stable` is the latest 5.x released code.

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).

```
$ 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.

d. 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 -n openshift-logging
```

Example output:

```
NAMESPACE          NAME                                       DISPLAY
VERSION            REPLACES       PHASE
...
openshift-logging  clusterlogging.5.0.0-202007012112.p0
OpenShift Logging  5.0.0-202007012112.p0             Succeeded
...
```

5. Create a OpenShift Logging instance:

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

```
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
```
name: "instance" ①
namespace: "openshift-logging"

spec:
managementState: "Managed" ②
logStore:
type: "elasticsearch" ③
retentionPolicy: ④
  application:
    maxAge: 1d
  infra:
    maxAge: 7d
  audit:
    maxAge: 7d
elasticsearch:
  nodeCount: ⑤
  storage:
    storageClassName: "<storage-class-name>" ⑥
size: 200G
resources: ⑦
  requests:
    memory: "8Gi"
proxy: ⑧
  resources:
    limits:
      memory: 256Mi
  requests:
    memory: 256Mi
redundancyPolicy: "SingleRedundancy"
visualization:
type: "kibana" ⑨
kibana:
  replicas: 1
curation:
type: "curator"
curator:
  schedule: "30 3 * * *" ⑩
collection:
logs:
  type: "fluentd" ⑪
  fluentd: {}
specify a retention policy for each log source or the Elasticsearch indices will not be created for that source.

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

6 Enter the name of an existing storage class for Elasticsearch storage. For best performance, specify a storage class that allocates block storage. If you do not specify a storage class, OpenShift Container Platform deploys OpenShift Logging with ephemeral storage only.

7 Specify the CPU and memory requests for Elasticsearch as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are 16G for the memory request and 1 for the CPU request.

8 Specify the CPU and memory requests for the Elasticsearch proxy as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are 256Mi for the memory request and 100m for the CPU request.

9 Settings for configuring Kibana. Using the CR, you can scale Kibana for redundancy and configure the CPU and memory for your Kibana pods. For more information, see Configuring the log visualizer.

10 Settings for configuring the Curator schedule. Curator is used to remove data that is in the Elasticsearch index format prior to OpenShift Container Platform 4.5 and will be removed in a later release.

11 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
```

**Example output**

```
<table>
<thead>
<tr>
<th>deployment</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>1</td>
<td>6m54s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-1</td>
<td>1/1</td>
<td>1</td>
<td>1</td>
<td>18h</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-2</td>
<td>1/1</td>
<td>0</td>
<td>1</td>
<td>6m49s</td>
</tr>
<tr>
<td>elasticsearch-cdm-x6kdekli-3</td>
<td>1/1</td>
<td>0</td>
<td>0</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
```

This creates the OpenShift Logging components, the Elasticsearch custom resource and components, and the Kibana interface.

6. Verify the install by listing the pods in the openshift-logging project.

You should see several pods for OpenShift Logging, Elasticsearch, Fluentd, and Kibana similar to the following list:

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

**Example output**

```
<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-66f77ffccbb-ppzb</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>7m</td>
</tr>
<tr>
<td>elasticsearch-cd-ftuhduuw-1-fcc4b9566-q6bhp</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m40s</td>
</tr>
<tr>
<td>elasticsearch-cd-ftuhduuw-2-7b4994dbfc-rdgc</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>2m36s</td>
</tr>
<tr>
<td>elasticsearch-cd-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>
</tbody>
</table>
```
3.3. POST-INSTALLATION TASKS

If you plan to use Kibana, you must manually create your Kibana index patterns and visualizations to explore and visualize data in Kibana.

3.3.1. Defining Kibana index patterns

An index pattern defines the Elasticsearch indices that you want to visualize. To explore and visualize data in Kibana, you must create an index pattern.

Prerequisites

- A user must have the `cluster-admin` role, the `cluster-reader` role, or both roles to view the `infra` and `audit` indices in Kibana. The default `kubeadmin` user has proper permissions to view these indices.

If you can view the pods and logs in the `default`, `kube-` and `openshift-` projects, you should be able to access these indices. You can use the following command to check if the current user has appropriate permissions:

```
$ oc auth can-i get pods/log -n <project>
```

Example output

```
yes
```

**NOTE**

The audit logs are not stored in the internal OpenShift Container Platform Elasticsearch instance by default. To view the audit logs in Kibana, you must use the Log Forwarding API to configure a pipeline that uses the `default` output for audit logs.

- Elasticsearch documents must be indexed before you can create index patterns. This is done automatically, but it might take a few minutes in a new or updated cluster.

Procedure

To define index patterns and create visualizations in Kibana:

1. In the OpenShift Container Platform console, click the Application Launcher and select Logging.

2. Create your Kibana index patterns by clicking Management → Index Patterns → Create index pattern:
   - Each user must manually create index patterns when logging into Kibana the first time to see logs for their projects.

```
see logs for their projects. Users must create an index pattern named **app** and use the
**@timestamp** time field to view their container logs.

- Each admin user must create index patterns when logged into Kibana the first time for the
  **app**, **infra**, and **audit** indices using the **@timestamp** time field.

3. Create Kibana Visualizations from the new index patterns.

### 3.3.2. Installing OpenShift Logging into a multitenant network

If you are deploying OpenShift Logging into a cluster that uses multitenant isolation mode, projects are isolated from other projects. As a result, network traffic is not allowed between pods or services in different projects.

Because the OpenShift Elasticsearch Operator and the Cluster Logging Operator are installed in different projects, you must explicitly allow access between the **openshift-operators-redhat** and **openshift-logging** projects. How you allow this access depends on how you configured multitenant isolation mode.

**Procedure**

To allow traffic between the OpenShift Elasticsearch Operator and the Cluster Logging Operator, perform one of the following:

- If you configured multitenant isolation mode with the OpenShift SDN CNI plug-in set to the **Multitenant** mode, use the following command to join the two projects:
  
  For example:

  ```
  $ oc adm pod-network join-projects --to=openshift-operators-redhat openshift-logging
  ```

- If you configured multitenant isolation mode with the OpenShift SDN CNI plug-in set to the **NetworkPolicy** mode, create a network policy object in the **openshift-logging** namespace that allows ingress from the **openshift-operators-redhat** project to the **openshift-logging** project. For example:

  ```
  kind: NetworkPolicy
  apiVersion: networking.k8s.io/v1
  metadata:
    name: allow-openshift-operators-redhat
  spec:
    ingress:
     - from:
        - namespaceSelector:
          matchLabels:
            project: openshift-operators-redhat

  ```

### 3.4. ADDITIONAL RESOURCES

- For more information on installing Operators, see [Installing Operators from the OperatorHub](#).
CHAPTER 4. CONFIGURING YOUR LOGGING DEPLOYMENT

4.1. ABOUT THE CLUSTER LOGGING CUSTOM RESOURCE

To configure OpenShift Logging, you customize the ClusterLogging custom resource (CR).

4.1.1. About the ClusterLogging custom resource

To make changes to your OpenShift Logging environment, create and modify the ClusterLogging custom resource (CR).

Instructions for creating or modifying a CR are provided in this documentation as appropriate.

The following example shows a typical custom resource for OpenShift Logging.

Sample ClusterLogging custom resource (CR)

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"  
  namespace: "openshift-logging"
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
  retentionPolicy:
    application:
      maxAge: 1d
    infra:
      maxAge: 7d
    audit:
      maxAge: 7d
    elasticsearch:
      nodeCount: 3
  resources:
    limits:
      memory: 16Gi
    requests:
      cpu: 500m
      memory: 16Gi
  storage:
    storageClassName: "gp2"
    size: "200G"
    redundancyPolicy: "SingleRedundancy"
  visualization:
    type: "kibana"
    kibana:
      resources:
        limits:
          memory: 736Mi
        requests:
          cpu: 100m
          memory: 736Mi
```
The CR name must be `instance`.

The CR must be installed to the `openshift-logging` namespace.

The Cluster Logging Operator management state. When set to `unmanaged` the operator is in an unsupported state and will not get updates.

Settings for the log store, including retention policy, the number of nodes, the resource requests and limits, and the storage class.

Settings for the visualizer, including the resource requests and limits, and the number of pod replicas.

Settings for curation, including the resource requests and limits, and curation schedule.

Settings for the log collector, including the resource requests and limits.

---

### 4.2. 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 project metadata.

You can configure the CPU and memory limits for the log collector and move the log collector pods to specific nodes. All supported modifications to the log collector can be performed through the `spec.collection.log.fluentd` stanza in the `ClusterLogging` custom resource (CR).

#### 4.2.1. About unsupported configurations

The supported way of configuring OpenShift Logging is by configuring it using the options described in this documentation. Do not use other configurations, as they are unsupported. Configuration paradigms might change across OpenShift Container Platform releases, and such cases can only be handled gracefully if all configuration possibilities are controlled. If you use configurations other than those
described in this documentation, your changes will disappear because the OpenShift Elasticsearch Operator and Cluster Logging Operator reconcile any differences. The Operators reverse everything to the defined state by default and by design.

NOTE
If you must perform configurations not described in the OpenShift Container Platform documentation, you must set your Cluster Logging Operator or OpenShift Elasticsearch Operator to Unmanaged. An unmanaged OpenShift Logging environment is not supported and does not receive updates until you return OpenShift Logging to Managed.

4.2.2. Viewing logging collector pods

You can view the Fluentd logging collector pods and the corresponding nodes that they are running on. The Fluentd logging collector pods run only in the openshift-logging project.

Procedure

- Run the following command in the openshift-logging project to view the Fluentd logging collector pods and their details:

  ```
  $ oc get pods --selector component=fluentd -o wide -n openshift-logging
  ```

Example output

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
<th>IP</th>
<th>NODE</th>
<th>NOMINATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>fluentd-8d69v</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>134m</td>
<td>10.130.2.30</td>
<td>master1.example.com</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>fluentd-bd225</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>134m</td>
<td>10.131.1.11</td>
<td>master2.example.com</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>fluentd-cvrzs</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>134m</td>
<td>10.130.0.21</td>
<td>master3.example.com</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>fluentd-gpqg2</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>134m</td>
<td>10.128.2.27</td>
<td>worker1.example.com</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>fluentd-l9j7j</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>134m</td>
<td>10.129.2.31</td>
<td>worker2.example.com</td>
<td>&lt;none&gt;</td>
</tr>
</tbody>
</table>

4.2.3. Configure log collector CPU and memory limits

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

Procedure

1. Edit the ClusterLogging custom resource (CR) in the openshift-logging project:

   ```
   $ oc -n openshift-logging edit ClusterLogging instance
   ```

   ```
   $ oc edit ClusterLogging instance
   ```

   ```
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
   ```
Specify the CPU and memory limits and requests as needed. The values shown are the default values.

4.2.4. Advanced configuration for the log forwarder

OpenShift Logging includes multiple Fluentd parameters that you can use for tuning the performance of the Fluentd log forwarder. With these parameters, you can change the following Fluentd behaviors:

- the size of Fluentd chunks and chunk buffer
- the Fluentd chunk flushing behavior
- the Fluentd chunk forwarding retry behavior

Fluentd collects log data in a single blob called a chunk. When Fluentd creates a chunk, the chunk is considered to be in the stage, where the chunk gets filled with data. When the chunk is full, Fluentd moves the chunk to the queue, where chunks are held before being flushed, or written out to their destination. Fluentd can fail to flush a chunk for a number of reasons, such as network issues or capacity issues at the destination. If a chunk cannot be flushed, Fluentd retries flushing as configured.

By default in OpenShift Container Platform, Fluentd uses the exponential backoff method to retry flushing, where Fluentd doubles the time it waits between attempts to retry flushing again, which helps reduce connection requests to the destination. You can disable exponential backoff and use the periodic retry method instead, which retries flushing the chunks at a specified interval. By default, Fluentd retries chunk flushing indefinitely. In OpenShift Container Platform, you cannot change the indefinite retry behavior.

These parameters can help you determine the trade-offs between latency and throughput.

- To optimize Fluentd for throughput, you could use these parameters to reduce network packet count by configuring larger buffers and queues, delaying flushes, and setting longer times between retries. Be aware that larger buffers require more space on the node file system.
- To optimize for low latency, you could use the parameters to send data as soon as possible, avoid the build-up of batches, have shorter queues and buffers, and use more frequent flush and retries.
You can configure the chunking and flushing behavior using the following parameters in the ClusterLogging custom resource (CR). The parameters are then automatically added to the Fluentd config map for use by Fluentd.

**NOTE**

These parameters are:

- Not relevant to most users. The default settings should give good general performance.
- Only for advanced users with detailed knowledge of Fluentd configuration and performance.
- Only for performance tuning. They have no effect on functional aspects of logging.

### Table 4.1. Advanced Fluentd Configuration Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>chunkLimitSize</strong></td>
<td>The maximum size of each chunk. Fluentd stops writing data to a chunk when it reaches this size. Then, Fluentd sends the chunk to the queue and opens a new chunk.</td>
<td><strong>8m</strong></td>
</tr>
<tr>
<td><strong>totalLimitSize</strong></td>
<td>The maximum size of the buffer, which is the total size of the stage and the queue. If the buffer size exceeds this value, Fluentd stops adding data to chunks and fails with an error. All data not in chunks is lost.</td>
<td><strong>8G</strong></td>
</tr>
<tr>
<td><strong>flushInterval</strong></td>
<td>The interval between chunk flushes. You can use <strong>s</strong> (seconds), <strong>m</strong> (minutes), <strong>h</strong> (hours), or <strong>d</strong> (days).</td>
<td><strong>1s</strong></td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Default</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>flushMode</td>
<td>The method to perform flushes:</td>
<td>interval</td>
</tr>
<tr>
<td></td>
<td>* lazy: Flush chunks based on the timekey parameter. You cannot modify the timekey parameter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* interval: Flush chunks based on the flushInterval parameter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* immediate: Flush chunks immediately after data is added to a chunk.</td>
<td></td>
</tr>
<tr>
<td>flushThreadCount</td>
<td>The number of threads that perform chunk flushing. Increasing the number of threads improves the flush throughput, which hides network latency.</td>
<td>2</td>
</tr>
<tr>
<td>overflowAction</td>
<td>The chunking behavior when the queue is full:</td>
<td>block</td>
</tr>
<tr>
<td></td>
<td>* throw_exception: Raise an exception to show in the log.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* block: Stop data chunking until the full buffer issue is resolved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* drop_oldest_chunk: Drop the oldest chunk to accept new incoming chunks. Older chunks have less value than newer chunks.</td>
<td></td>
</tr>
<tr>
<td>retryMaxInterval</td>
<td>The maximum time in seconds for the exponential_backoff retry method.</td>
<td>300s</td>
</tr>
</tbody>
</table>
### retryType
The retry method when flushing fails:

- **exponential_backoff**: Increase the time between flush retries. Fluentd doubles the time it waits until the next retry until the `retry_max_interval` parameter is reached.
- **periodic**: Retries flushes periodically, based on the `retryWait` parameter.

### retryWait
The time in seconds before the next chunk flush. 1s

For more information on the Fluentd chunk lifecycle, see Buffer Plugins in the Fluentd documentation.

#### Procedure

1. Edit the **ClusterLogging** custom resource (CR) in the **openshift-logging** project:

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

2. Add or modify any of the following parameters:

   ```yaml
   apiVersion: logging.openshift.io/v1
   kind: ClusterLogging
   metadata:
     name: instance
     namespace: openshift-logging
   spec:
     forwarder:
       fluentd:
         buffer:
           chunkLimitSize: 8m
           flushInterval: 5s
           flushMode: interval
           flushThreadCount: 3
           overflowAction: throw_exception
           retryMaxInterval: "300s"
           retryType: periodic
           retryWait: 1s
           totalLimitSize: 32m
   ...
   ```

   1 Specify the maximum size of each chunk before it is queued for flushing.
Specify the interval between chunk flushes.

Specify the method to perform chunk flushes: lazy, interval, or immediate.

Specify the number of threads to use for chunk flushes.

Specify the chunking behavior when the queue is full: throw_exception, block, or drop_oldest_chunk.

Specify the maximum interval in seconds for the exponential_backoff chunk flushing method.

Specify the retry type when chunk flushing fails: exponential_backoff or periodic.

Specify the time in seconds before the next chunk flush.

Specify the maximum size of the chunk buffer.

3. Verify that the Fluentd pods are redeployed:

   $ oc get pods -n openshift-logging

4. Check that the new values are in the fluentd config map:

   $ oc extract configmap/fluentd --confirm

   Example fluentd.conf

   <buffer>
   @type file
   path '/var/lib/fluentd/default'
   flush_mode interval
   flush_interval 5s
   flush_thread_count 3
   flush_at_shutdown true
   retry_type periodic
   retry_wait 1s
   retry_max_interval 300s
   retry_forever true
   queued_chunks_limit_size "#{ENV['BUFFER_QUEUE_LIMIT'] || '32'}"
   total_limit_size "#{ENV['TOTAL_LIMIT_SIZE'] || 8589934592}" #32M
   chunk_limit_size "#{ENV['BUFFER_SIZE_LIMIT'] || '8m'}"
   overflow_action throw_exception
   </buffer>

4.2.5. Removing unused components if you do not use the default Elasticsearch log store

As an administrator, in the rare case that you forward logs to a third-party log store and do not use the default Elasticsearch log store, you can remove several unused components from your logging cluster.

In other words, if you do not use the default Elasticsearch log store, you can remove the internal Elasticsearch logStore, Kibana visualization, and log curation components from the ClusterLogging custom resource (CR). Removing these components is optional but saves resources.
Prerequisites

- Verify that your log forwarder does not send log data to the default internal Elasticsearch cluster. Inspect the ClusterLogForwarder CR YAML file that you used to configure log forwarding. Verify that it does not have an outputRefs element that specifies default. For example:

```
outputRefs:
  - default
```

**WARNING**

Suppose the ClusterLogForwarder CR forwards log data to the internal Elasticsearch cluster, and you remove the logStore component from the ClusterLogging CR. In that case, the internal Elasticsearch cluster will not be present to store the log data. This absence can cause data loss.

Procedure

1. Edit the ClusterLogging custom resource (CR) in the openshift-logging project:

   ```
   $ oc edit ClusterLogging instance
   ```

2. If they are present, remove the logStore, visualization, curation stanzas from the ClusterLogging CR.

3. Preserve the collection stanza of the ClusterLogging CR. The result should look similar to the following example:

   ```
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
     namespace: "openshift-logging"
   spec:
     managementState: "Managed"
     collection:
       logs:
         type: "fluentd"
         fluentd: {}
   ```

4. Verify that the Fluentd pods are redeployed:

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

Additional resources

- Forwarding logs to third party systems
4.3. CONFIGURING THE LOG STORE

OpenShift Container Platform uses Elasticsearch 6 (ES) to store and organize the log data.

You can make modifications to your log store, including:

- storage for your Elasticsearch cluster
- shard replication across data nodes in the cluster, from full replication to no replication
- external access to Elasticsearch data

Elasticsearch is a memory-intensive application. Each Elasticsearch node needs at least 16G of memory for both memory requests and limits, unless you specify otherwise in the `ClusterLogging` 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, up to a maximum of 64G for each Elasticsearch node.

Each Elasticsearch node can operate with a lower memory setting, though this is not recommended for production environments.

4.3.1. Forward audit logs to the log store

Because the internal OpenShift Container Platform Elasticsearch log store does not provide secure storage for audit logs, by default audit logs are not stored in the internal Elasticsearch instance.

If you want to send the audit logs to the internal log store, for example to view the audit logs in Kibana, you must use the Log Forward API.

**IMPORTANT**

The internal OpenShift Container Platform Elasticsearch log store 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 Logging does not comply with those regulations.

**Procedure**

To use the Log Forward API to forward audit logs to the internal Elasticsearch instance:

1. Create a `ClusterLogForwarder` CR YAML file or edit your existing CR:

   - Create a CR to send all log types to the internal Elasticsearch instance. You can use the following example without making any changes:

     ```yaml
     apiVersion: logging.openshift.io/v1
     kind: ClusterLogForwarder
     metadata:
       name: instance
       namespace: openshift-logging
     spec:
       pipelines: 1
     - name: all-to-default
       inputRefs:
       - infrastructure
       - application
     ```
A pipeline defines the type of logs to forward using the specified output. The default output forwards logs to the internal Elasticsearch instance.

**NOTE**

You must specify all three types of logs in the pipeline: application, infrastructure, and audit. If you do not specify a log type, those logs are not stored and will be lost.

- If you have an existing `ClusterLogForwarder` CR, add a pipeline to the default output for the audit logs. You do not need to define the default output. For example:

```yaml
apiVersion: "logging.openshift.io/v1"
kind: ClusterLogForwarder
metadata:
  name: instance
  namespace: openshift-logging
spec:
  outputs:
    - name: elasticsearch-insecure
      type: "elasticsearch"
      url: http://elasticsearch-insecure.messaging.svc.cluster.local
      insecure: true
    - name: elasticsearch-secure
      type: "elasticsearch"
      url: https://elasticsearch-secure.messaging.svc.cluster.local
      secret:
        name: es-audit
    - name: secureforward-offcluster
      type: "fluentdForward"
      url: https://secureforward.offcluster.com:24224
      secret:
        name: secureforward
  pipelines:
    - name: container-logs
      inputRefs:
        - application
      outputRefs:
        - secureforward-offcluster
    - name: infra-logs
      inputRefs:
        - infrastructure
      outputRefs:
        - elasticsearch-insecure
    - name: audit-logs
      inputRefs:
        - audit
      outputRefs:
        - elasticsearch-secure
      default
```
This pipeline sends the audit logs to the internal Elasticsearch instance in addition to an external instance.

Additional resources

For more information on the Log Forwarding API, see [Forwarding logs using the Log Forwarding API](#).

4.3.2. Configuring log retention time

You can specify how long the default Elasticsearch log store keeps indices using a separate retention policy for each of the three log sources: infrastructure logs, application logs, and audit logs. The retention policy, which you configure using the `maxAge` parameter in the Cluster Logging custom resource (CR), is considered for the Elasticsearch roll over schedule and determines when Elasticsearch deletes the rolled-over indices.

Elasticsearch rolls over an index, moving the current index and creating a new index, when an index matches any of the following conditions:

- The index is older than the `rollover.maxAge` value in the Elasticsearch CR.
- The index size is greater than 40 GB × the number of primary shards.
- The index doc count is greater than 40960 KB × the number of primary shards.

Elasticsearch deletes the rolled-over indices are deleted based on the retention policy you configure.

If you do not create a retention policy for any of the log sources, logs are deleted after seven days by default.

**IMPORTANT**

If you do not specify a retention policy for all three log sources, only logs from the sources with a retention policy are stored. For example, if you set a retention policy for the infrastructure and application logs, but do not set a retention policy for audit logs, the audit logs will not be retained and there will be no audit-index in Elasticsearch or Kibana.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

Procedure

To configure the log retention time:

1. Edit the `ClusterLogging` CR to add or modify the `retentionPolicy` parameter:

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
...
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
  retentionPolicy:
    application:
```

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
...
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
  retentionPolicy:
    application:
```
Specify the time that Elasticsearch should retain each log source. Enter an integer and a time designation: weeks(w), hours(h/H), minutes(m) and seconds(s). For example, 1d for one day. Logs older than the maxAge are deleted. By default, logs are retained for seven days.

2. You can verify the settings in the Elasticsearch custom resource (CR). For example, the Cluster Logging Operator updated the following Elasticsearch CR to configure a retention policy that includes settings to roll over active indices for the infrastructure logs every eight hours and the rolled-ver indices are deleted seven days after rollover. OpenShift Container Platform checks every 15 minutes to determine if the indices need to be rolled over.

For each log source, the retention policy indicates when to delete and rollover logs for that source.

When OpenShift Container Platform deletes the rolled-over indices. This setting is the maxAge you set in the ClusterLogging CR.

The index age for OpenShift Container Platform to consider when rolling over the indices. This value is determined from the maxAge you set in the ClusterLogging CR.

When OpenShift Container Platform checks if the indices should be rolled over. This setting is the default and cannot be changed.
NOTE

Modifying the Elasticsearch CR is not supported. All changes to the retention policies must be made in the ClusterLogging CR.

The OpenShift Elasticsearch Operator deploys a cron job to roll over indices for each mapping using the defined policy, scheduled using the pollInterval.

$ oc get cronjob

Example output

<table>
<thead>
<tr>
<th>NAME</th>
<th>SCHEDULE</th>
<th>SUSPEND</th>
<th>ACTIVE</th>
<th>LAST SCHEDULE</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>curator</td>
<td>*/10 * * * *</td>
<td>False</td>
<td>0</td>
<td>&lt;none&gt;</td>
<td>5s</td>
</tr>
<tr>
<td>elasticsearch-im-app</td>
<td>*/15 * * * *</td>
<td>False</td>
<td>0</td>
<td>&lt;none&gt;</td>
<td>4s</td>
</tr>
<tr>
<td>elasticsearch-im-audit</td>
<td>*/15 * * * *</td>
<td>False</td>
<td>0</td>
<td>&lt;none&gt;</td>
<td>4s</td>
</tr>
<tr>
<td>elasticsearch-im-infra</td>
<td>*/15 * * * *</td>
<td>False</td>
<td>0</td>
<td>&lt;none&gt;</td>
<td>4s</td>
</tr>
</tbody>
</table>

4.3.3. Configuring CPU and memory requests for the log store

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

NOTE

In large-scale clusters, the default memory limit for the Elasticsearch proxy container might not be sufficient, causing the proxy container to be OOMKilled. If you experience this issue, increase the memory requests and limits for the Elasticsearch proxy.

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

- OpenShift Logging and Elasticsearch must be installed.

Procedure

1. Edit the ClusterLogging custom resource (CR) in the openshift-logging project:

   $ oc edit ClusterLogging instance

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
   ...
   spec:
     logStore:
       type: "elasticsearch"
   ```
Specify the CPU and memory requests for Elasticsearch as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are **16Gi** for the memory request and **1** for the CPU request.

Specify the CPU and memory requests for the Elasticsearch proxy as needed. If you leave these values blank, the OpenShift Elasticsearch Operator sets default values that should be sufficient for most deployments. The default values are **256Mi** for the memory request and **100m** for the CPU request.

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

For example:

```yaml
resources:
  limits:
    memory: "32Gi"
  requests:
    cpu: "8"
    memory: "32Gi"
```

Kubernetes generally adheres the node 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 memory you want, assuming the node has the memory available.

### 4.3.4. Configuring replication policy for the log store

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

**Prerequisites**

- OpenShift Logging and Elasticsearch must be installed.

**Procedure**

1. Edit the **ClusterLogging** custom resource (CR) in the **openshift-logging** project:

   ```bash
   $ oc edit clusterlogging instance
   ```
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.

### 4.3.5. Scaling down Elasticsearch pods

Reducing the number of Elasticsearch pods in your cluster can result in data loss or Elasticsearch performance degradation.

If you scale down, you should scale down by one pod at a time and allow the cluster to re-balance the shards and replicas. After the Elasticsearch health status returns to **green**, you can scale down by another pod.

**NOTE**

If your Elasticsearch cluster is set to **ZeroRedundancy**, you should not scale down your Elasticsearch pods.
4.3.6. Configuring persistent storage for the log store

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

**WARNING**

Using NFS storage as a volume or a persistent volume (or via NAS such as Gluster) is not supported for Elasticsearch storage, as Lucene relies on file system behavior that NFS does not supply. Data corruption and other problems can occur.

**Prerequisites**

- OpenShift Logging and Elasticsearch must be installed.

**Procedure**

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

   ```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.

   **NOTE**

   If you use a local volume for persistent storage, do not use a raw block volume, which is described with `volumeMode: block` in the `LocalVolume` object. Elasticsearch cannot use raw block volumes.

4.3.7. Configuring the log store for emptyDir storage

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

When using emptyDir, if log storage is restarted or redeployed, you will lose data.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

Procedure

1. Edit the `ClusterLogging` CR to specify emptyDir:

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

4.3.8. Performing an Elasticsearch rolling cluster restart

Perform a rolling restart when you change the `elasticsearch` config map 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.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.
- Install the OpenShift Container Platform `es_util` tool

Procedure

To perform a rolling cluster restart:

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

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

2. Get the names of the Elasticsearch pods:

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

3. Perform a shard synced flush using the OpenShift Container Platform `es_util` tool to ensure there are no pending operations waiting to be written to disk prior to shutting down:

   ```bash
   $ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- es_util --query="_flush/synced" -XPOST
   ```

   For example:

   ```bash
   $ oc exec -c elasticsearch-cdm-5ceex6ts-1-dod6c4c7c-jpw6 -c elasticsearch -- es_util --query="_flush/synced" -XPOST
   ```
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 -d '{ "persistent": { "cluster.routing.allocation.enable": "primaries" } }'
```

For example:

```
$ oc exec elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -c elasticsearch -- es_util --query="_cluster/settings" -XPUT -d '{ "persistent": { "cluster.routing.allocation.enable": "primaries" } }'
```

**Example output**

```
{"acknowledged":true,"persistent":{"cluster":{"routing":{"allocation": {"enable":"primaries"}}}},"transient":null}
```

5. After the command is 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:

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

For example:

```
$ oc rollout resume deployment/elasticsearch-cdm-0-1
```

**Example output**

```
deployment.extensions/elasticsearch-cdm-0-1 resumed
```

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

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

**Example output**

```
NAME                                            READY   STATUS    RESTARTS   AGE
elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6k    2/2     Running   0          22h
elasticsearch-cdm-5ceex6ts-2-1799564cb-f9mj7    2/2     Running   0          22h
elasticsearch-cdm-5ceex6ts-3-585968dc68-k7kjr    2/2     Running   0          22h
```
b. After the deployments are complete, reset the pod to disallow rollouts:

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

For example:

```bash
$ oc rollout pause deployment/elasticsearch-cdm-0-1
```

**Example output**

```
deployment.extensions/elasticsearch-cdm-0-1 paused
```

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

```bash
$ oc exec <any_es_pod_in_the_cluster> -c elasticsearch -- es_util --query=_cluster/health?pretty=true
```

**NOTE**

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:

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

```
{
  "cluster_name" : "elasticsearch",
  "status" : "yellow",
  "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 value is **green** or **yellow** before proceeding.

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

7. After 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 -d '{ "persistent": { "cluster.routing.allocation.enable" : "all" } }

For example:

$ oc exec elasticsearch-cdm-5ceex6ts-1-dcd6c4c7c-jpw6 -c elasticsearch -- es_util --query="_cluster/settings" -XPUT -d '{ "persistent": { "cluster.routing.allocation.enable" : "all" } }

Example output

```
{
  "acknowledged" : true,
  "persistent" : { },
  "transient" : {
    "cluster" : {
      "routing" : {
        "allocation" : {
          "enable" : "all"
        }
      }
    }
  }
}
```

### 4.3.9. Exposing the log store service as a route

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

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

- The **Authorization: Bearer ${token}**

- The Elasticsearch reencrypt route and an Elasticsearch API request.

Internally, you can access the log store service using the log store cluster IP, which you can get by using either of the following commands:

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

**Example output**

```
172.30.183.229
```

```
$ oc get service elasticsearch -n openshift-logging
```

**Example output**

```

```
You can check the cluster IP address with a command similar to the following:

```
```

**Example output**

```
% 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**

- OpenShift Logging and Elasticsearch must be installed.
- You must have access to the project to be able to access to the logs.

**Procedure**

To expose the log store externally:

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

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

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

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

**Example output**

```
admin-ca
```

3. Create the route for the log store 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: localhost
     to:
       kind: Service
       name: elasticsearch
       tls:
         termination: reencrypt
         destinationCACertificate: |
   ```
Add the log store 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 log store CA certificate to the route YAML you created:

```
$ cat ./admin-ca | sed -e "s/\n/ /" >> <file-name>-yaml
```

c. Create the route:

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

**Example output**

```
route.route.openshift.io/elasticsearch created
```

4. Check that the Elasticsearch service is exposed:

a. Get the token of this service account to be used in the request:

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

b. Set the `elasticsearch` route you created as an environment variable.

```
$ routeES=`oc get route elasticsearch -o jsonpath={.spec.host}`
```

c. To verify the route was successfully created, run the following command that accesses Elasticsearch through the exposed route:

```
```

The response appears similar to the following:

**Example output**

```
{
    "name": "elasticsearch-cdm-i40ktba0-1",
    "cluster_name": "elasticsearch",
    "cluster_uuid": "0eY-tJzcR3K0dpgeMJo-MQ",
    "version": {
        "number": "6.8.1",
        "build_flavor": "oss",
        "build_type": "zip",
        "build_hash": "Unknown",
        "build_date": "Unknown",
        "build_snapshot": true,
        "lucene_version": "7.7.0",
        "minimum_wire_compatibility_version": "5.6.0",
        "minimum_index_compatibility_version": "5.0.0"
    },
    "<tagline>": "<for search>
```


4.4. CONFIGURING THE LOG VISUALIZER

OpenShift Container Platform uses Kibana to display the log data collected by OpenShift Logging. You can scale Kibana for redundancy and configure the CPU and memory for your Kibana nodes.

4.4.1. Configuring CPU and memory limits

The OpenShift Logging components allow for adjustments to both the CPU and memory limits.

Procedure

1. Edit the `ClusterLogging` custom resource (CR) in the `openshift-logging` project:

   ```bash
   $ oc -n openshift-logging edit ClusterLogging instance
   ```

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: "ClusterLogging"
   metadata:
     name: "instance"
     namespace: openshift-logging
   ...
   spec:
     managementState: "Managed"
     logStore:
       type: "elasticsearch"
       elasticsearch:
         nodeCount: 3
         resources: 1
         limits:
           memory: 16Gi
           cpu: 200m
           memory: 16Gi
       storage:
         storageClassName: "gp2"
         size: "200G"
         redundancyPolicy: "SingleRedundancy"
   visualization:
     type: "kibana"
     kibana:
       resources: 2
       limits:
         memory: 1Gi
         cpu: 500m
         memory: 1Gi
       proxy:
         resources: 3
         limits:
           memory: 100Mi
   ```
Specify the CPU and memory limits and requests for the log store as needed. For Elasticsearch, you must adjust both the request value and the limit value.

Specify the CPU and memory limits and requests for the log visualizer as needed.

Specify the CPU and memory limits and requests for the log curator as needed.

Specify the CPU and memory limits and requests for the log collector as needed.

4.4.2. Scaling redundancy for the log visualizer nodes

You can scale the pod that hosts the log visualizer for redundancy.

Procedure

1. Edit the `ClusterLogging` 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:
   ```
Specify the number of Kibana nodes.

4.5. CONFIGURING OPENSSHIFT LOGGING STORAGE

Elasticsearch is a memory-intensive application. The default OpenShift Logging installation deploys 16G of memory for both memory requests and memory 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 environments.

4.5.1. Storage considerations for OpenShift Logging and OpenShift Container Platform

A persistent volume is required for each Elasticsearch deployment configuration. On OpenShift Container Platform this is achieved using persistent volume claims.

NOTE

If you use a local volume for persistent storage, do not use a raw block volume, which is described with `volumeMode: block` in the `LocalVolume` object. Elasticsearch cannot use raw block volumes.

The OpenShift Elasticsearch Operator names the PVCs using the Elasticsearch resource name.

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

Elasticsearch requires sufficient memory to perform large merge operations. If it does not have enough memory, it becomes unresponsive. To avoid this problem, evaluate how much application log data you need, and allocate approximately double that amount of free storage capacity.

By default, when storage capacity is 85% full, 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 a 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 default values. Although the alerts use the same default values, you cannot change these values in the alerts.

4.5.2. Additional resources

- Configuring persistent storage for the log store
4.6. CONFIGURING CPU AND MEMORY LIMITS FOR OPENSOURCE LOGGING COMPONENTS

You can configure both the CPU and memory limits for each of the OpenShift Logging components as needed.

4.6.1. Configuring CPU and memory limits

The OpenShift Logging components allow for adjustments to both the CPU and memory limits.

Procedure

1. Edit the `ClusterLogging` custom resource (CR) in the `openshift-logging` project:

   ```
   $ oc -n openshift-logging edit ClusterLogging instance
   ```

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

   spec:
     managementState: "Managed"
     logStore:
       type: "elasticsearch"
       elasticsearch:
         nodeCount: 3
       resources:
         limits:
           memory: 16Gi
           cpu: 200m
           memory: 16Gi
       storage:
         storageClassName: "gp2"
         size: "200G"
         redundancyPolicy: "SingleRedundancy"
       visualization:
         type: "kibana"
       kibana:
         resources:
           limits:
             memory: 1Gi
             cpu: 500m
             memory: 1Gi
       proxy:
         resources:
           limits:
             memory: 100Mi
             requests:
   ```
Specify the CPU and memory limits and requests for the log store as needed. For Elasticsearch, you must adjust both the request value and the limit value.

Specify the CPU and memory limits and requests for the log visualizer as needed.

Specify the CPU and memory limits and requests for the log curator as needed.

Specify the CPU and memory limits and requests for the log collector as needed.

### 4.7. USING TOLERATIONS TO CONTROL OPENSOURCES LOGGING POD PLACEMENT

You can use taints and tolerations to ensure that OpenShift 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 OpenShift Logging CR with tolerations**

```yaml
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
namespace: openshift-logging
...
spec:
  managementState: "Managed"
logStore:
  type: "elasticsearch"
elasticsearch:
  nodeCount: 3
tolerations: 1
  - key: "logging"
    operator: "Exists"
    effect: "NoExecute"
    tolerationSeconds: 6000
resources:
  limits:
    memory: 16Gi
  requests:
    cpu: 200m
    memory: 16Gi
storage: {}
redundancyPolicy: "ZeroRedundancy"
visualization:
  type: "kibana"
kibana:
  tolerations: 2
    - key: "logging"
      operator: "Exists"
      effect: "NoExecute"
      tolerationSeconds: 6000
resources:
  limits:
    memory: 2Gi
  requests:
    cpu: 100m
    memory: 1Gi
replicas: 1
collection:
logs:
  type: "fluentd"
fluentd:
  tolerations: 3
    - key: "logging"
      operator: "Exists"
      effect: "NoExecute"
      tolerationSeconds: 6000
resources:
  limits:
    memory: 2Gi
  requests:
    cpu: 100m
    memory: 1Gi

1 This toleration is added to the Elasticsearch pods.
2 This toleration is added to the Kibana pod.
3. This toleration is added to the logging collector pods.

4.7.1. Using tolerations to control the log store pod placement

You can control which nodes the log store pods runs on and prevent other workloads from using those nodes by using tolerations on the pods.

You apply tolerations to the log store pods through the `ClusterLogging` 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 log store pods can run on that node.

By default, the log store pods have the following toleration:

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

Prerequisites

- OpenShift 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 OpenShift Logging pods:

   ```
   $ oc adm taint nodes <node-name> <key>=<value>:<effect>
   
   For example:
   
   $ oc adm taint nodes node1 elasticsearch=node:NoExecute
   ```

   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 `ClusterLogging` CR to configure a toleration for the Elasticsearch pods:

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

   1. Specify the key that you added to the node.
Specify the **Exists** operator to require a taint with the key `elasticsearch` to be present on the Node.

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 could be scheduled onto `node1`.

### 4.7.2. Using tolerations to control the log visualizer pod placement

You can control the node where the log visualizer pod runs and prevent other workloads from using those nodes by using tolerations on the pods.

You apply tolerations to the log visualizer pod through the `ClusterLogging` 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**

- OpenShift 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 log visualizer 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 `ClusterLogging` CR to configure a toleration for the Kibana pod:

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

   ```
   1 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**.

### 4.7.3. 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 **ClusterLogging** 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**

- OpenShift 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** stanza of the **ClusterLogging** custom resource (CR) to configure a toleration for the logging collector pods:

   ```
collection:
   logs:
     type: "fluentd"
     fluentd:
       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.

4.7.4. Additional resources
For more information about taints and tolerations, see Controlling pod placement using node taints.

4.8. MOVING OPENSIFT LOGGING RESOURCES WITH NODE SELECTORS
You can use node selectors to deploy the Elasticsearch, Kibana, and Curator pods to different nodes.

4.8.1. Moving OpenShift Logging resources
You can configure the Cluster Logging Operator to deploy the pods for any or all of the OpenShift 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.

Prerequisites
- OpenShift Logging and Elasticsearch must be installed. These features are not installed by default.

Procedure
1. Edit the ClusterLogging custom resource (CR) in the openshift-logging project:

```
$ oc edit ClusterLogging instance

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

....

spec:
```
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.

**Verification**

To verify that a component has moved, you can use the `oc get pod -o wide` command.

For example:

- You want to move the Kibana pod from the `ip-10-0-147-79.us-east-2.compute.internal` node:

  ```bash
  $ oc get pod kibana-5b8bd4f4f9-ccpq9 -o wide
  ```
Example output

<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>NOMINATED NODE</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>27s</td>
<td>10.129.2.18</td>
<td>ip-10-0-147-79.us-east-2.compute.internal</td>
</tr>
</tbody>
</table>

- You want to move the Kibana Pod to the `ip-10-0-139-48.us-east-2.compute.internal` node, a dedicated infrastructure node:

  ```
  $ oc get nodes
  ```

Example output

<table>
<thead>
<tr>
<th>NAME</th>
<th>STATUS</th>
<th>ROLES</th>
<th>AGE</th>
<th>VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ip-10-0-133-216.us-east-2.compute.internal</td>
<td>Ready</td>
<td>master</td>
<td>60m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-139-146.us-east-2.compute.internal</td>
<td>Ready</td>
<td>master</td>
<td>60m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-139-192.us-east-2.compute.internal</td>
<td>Ready</td>
<td>worker</td>
<td>51m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-139-241.us-east-2.compute.internal</td>
<td>Ready</td>
<td>worker</td>
<td>51m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-147-79.us-east-2.compute.internal</td>
<td>Ready</td>
<td>worker</td>
<td>51m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-152-241.us-east-2.compute.internal</td>
<td>Ready</td>
<td>master</td>
<td>60m</td>
<td>v1.20.0</td>
</tr>
<tr>
<td>ip-10-0-139-48.us-east-2.compute.internal</td>
<td>Ready</td>
<td>infra</td>
<td>51m</td>
<td>v1.20.0</td>
</tr>
</tbody>
</table>

Note that the node has a `node-role.kubernetes.io/infra: ""` label:

```
$ oc get node ip-10-0-139-48.us-east-2.compute.internal -o yaml
```

Example output

```
kind: Node
apiVersion: v1
metadata:
  name: ip-10-0-139-48.us-east-2.compute.internal
  selfLink: /api/v1/nodes/ip-10-0-139-48.us-east-2.compute.internal
  uid: 62038aa9-661f-41d7-ba93-b5f1b6ef8751
  resourceVersion: '39083'
  creationTimestamp: '2020-04-13T19:07:55Z'
  labels:
    node-role.kubernetes.io/infra: ""
  ....
```

- To move the Kibana pod, edit the `ClusterLogging` CR to add a node selector:

  ```
  apiVersion: logging.openshift.io/v1
  kind: ClusterLogging
  ....
  spec:
  ....
  visualization:
  ```
Add a node selector to match the label in the node specification.

- After you save the CR, the current Kibana pod is terminated and new pod is deployed:

```bash
$ oc get pods
```

**Example output**

<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-84d98649c4-zb9g7</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>29m</td>
</tr>
<tr>
<td>elasticsearch-cdm-hwv01pf7-1-56588f554f-kpmlg</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>elasticsearch-cdm-hwv01pf7-2-84c877d75d-75wqj</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>elasticsearch-cdm-hwv01pf7-3-f5d95b87b-4nx78</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-42dzz</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-d74rq</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-m5vr9</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-nkxl7</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-pdvqb</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>fluentd-tflh6</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>28m</td>
</tr>
<tr>
<td>kibana-5b8bd4f4f9-ccpq9</td>
<td>2/2</td>
<td>Terminating</td>
<td>0</td>
<td>4m11s</td>
</tr>
<tr>
<td>kibana-7d85dcffc8-bffp</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>33s</td>
</tr>
</tbody>
</table>

- The new pod is on the **ip-10-0-139-48.us-east-2.compute.internal** node:

```bash
$ oc get pod kibana-7d85dcffc8-bffp -o wide
```

**Example output**

<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>kibana-7d85dcffc8-bffp</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>43s</td>
<td>10.131.0.22</td>
<td>ip-10-0-139-48.us-east-2.compute.internal</td>
</tr>
</tbody>
</table>

- After a few moments, the original Kibana pod is removed.

```bash
$ oc get pods
```

**Example output**

<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-84d98649c4-zb9g7</td>
<td>1/1</td>
<td>Running</td>
<td>0</td>
<td>30m</td>
</tr>
<tr>
<td>elasticsearch-cdm-hwv01pf7-1-56588f554f-kpmlg</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>29m</td>
</tr>
<tr>
<td>elasticsearch-cdm-hwv01pf7-2-84c877d75d-75wqj</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>29m</td>
</tr>
</tbody>
</table>
4.9. 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 `RateLimitIntervalSec=30s` and `RateLimitBurst=10000` (or even higher if necessary) to prevent the journal from losing entries.

4.9.1. Configuring systemd-journald for OpenShift 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 OpenShift 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=yes 1
ForwardToConsole=no 2
ForwardToSyslog=no
MaxRetentionSec=1month 3
RateLimitBurst=10000 4
RateLimitIntervalSec=30s
Storage=persistent 5
SyncIntervalSec=1s 6
SystemMaxUse=8g 7
SystemKeepFree=20% 8
SystemMaxFileSize=10M 9
```

1. 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`.

2. 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.

3. 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 1 month.

4. 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 `RateLimitIntervalSec=30s` and `RateLimitBurst=10000`, which are the defaults.

5. 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.

6. 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.

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

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

9. 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](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 jrn_l_conf=$( cat /journald.conf | base64 -w0 )
   ```

3. Create a new **MachineConfig** object for master or worker and add the `journal.conf` parameters:
   For example:

   ```yaml
   apiVersion: machineconfiguration.openshift.io/v1
   kind: MachineConfig
   ```
Set the permissions for the journal.conf file. It is recommended to set **0644** permissions.

Specify the path to the base64-encoded journal.conf file.

4. Create the machine config:

   $ oc apply -f <filename>.yaml

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

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

   $ oc describe machineconfigpool/worker

Example output

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

Conditions:
Message: All nodes are updating to rendered-worker-913514517bcea7c93bd446f4830bc64e

4.10. CONFIGURING THE LOG CURATOR

You can configure log retention time. That is, you can specify how long the default Elasticsearch log store keeps indices by configuring a separate retention policy for each of the three log sources: infrastructure logs, application logs, and audit logs. For instructions, see Configuring log retention time.
NOTE
Configuring log retention time is recommended method for curating log data: It works with both the current data model and the previous data model from OpenShift Container Platform 4.4 and earlier.

Optionally, to remove Elasticsearch indices that use the data model from OpenShift Container Platform 4.4 and earlier, you can also use the Elasticsearch Curator. The following sections explain how to use the Elasticsearch Curator.

IMPORTANT
The Elasticsearch Curator is deprecated in OpenShift Container Platform 4.7 (OpenShift Logging 5.0) and will be removed in OpenShift Logging 5.1.

4.10.1. Configuring the Curator schedule

You can specify the schedule for Curator using the Cluster Logging custom resource created by the OpenShift Logging installation.

IMPORTANT
The Elasticsearch Curator is deprecated in OpenShift Container Platform 4.7 (OpenShift Logging 5.0) and will be removed in OpenShift Logging 5.1.

Prerequisites
- OpenShift Logging and Elasticsearch must be installed.

Procedure
To configure the Curator schedule:

1. Edit the ClusterLogging custom resource in the openshift-logging project:

```
$ oc edit clusterlogging instance

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

curation:
  curator:
    schedule: 30 3 * * *
    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.

4.10.2. Configuring Curator index deletion
You can configure Elasticsearch Curator to delete Elasticsearch data that uses the data model prior to OpenShift Container Platform version 4.5. You can configure per-project and global settings. Global settings apply to any project not specified. Per-project settings override global settings.

IMPORTANT
The Elasticsearch Curator is deprecated in OpenShift Container Platform 4.7 (OpenShift Logging 5.0) and will be removed in OpenShift Logging 5.1.

Prerequisites
- OpenShift 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:

   config.yaml: |
   project_name:
   action
   unit:value

   The available parameters are:

   Table 4.2. 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 myapp-devel. For OpenShift Container Platform operations logs, use the name .operations as the project name.</td>
</tr>
<tr>
<td>action</td>
<td>The action to take, currently only delete is allowed.</td>
</tr>
<tr>
<td>unit</td>
<td>The period to use for deletion, days, weeks, or months.</td>
</tr>
<tr>
<td>value</td>
<td>The number of units.</td>
</tr>
</tbody>
</table>

   Table 4.3. Filter options
### Variable Name | Description
--- | ---
.defaults | Use `.defaults` as the `project_name` to set the defaults for projects that are not specified.
.regex | The list of regular expressions that match project names.
pattern | The valid and properly escaped regular expression pattern enclosed by single quotation marks.

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:
    delete:
      days: 1
  myapp-qe:
    delete:
      weeks: 1
  .regex:
    - pattern: `^project\..+-dev\..*$`
      delete:
        days: 1
    - pattern: `^project\..+-test\..*$`
      delete:
        days: 2
```

OpenShift Container Platform 4.7 Logging
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).

4.11. MAINTENANCE AND SUPPORT

4.11.1. About unsupported configurations

The supported way of configuring OpenShift Logging is by configuring it using the options described in this documentation. Do not use other configurations, as they are unsupported. Configuration paradigms might change across OpenShift Container Platform releases, and such cases can only be handled gracefully if all configuration possibilities are controlled. If you use configurations other than those described in this documentation, your changes will disappear because the OpenShift Elasticsearch Operator and Cluster Logging Operator reconcile any differences. The Operators reverse everything to the defined state by default and by design.

NOTE

If you must perform configurations not described in the OpenShift Container Platform documentation, you must set your Cluster Logging Operator or OpenShift Elasticsearch Operator to Unmanaged. An unmanaged OpenShift Logging environment is not supported and does not receive updates until you return OpenShift Logging to Managed.

4.11.2. Unsupported configurations

You must set the Cluster Logging Operator to the unmanaged state to modify the following components:

- the Curator cron job
- the Elasticsearch CR
- the Kibana deployment
- the fluent.conf file
- the Fluentd daemon set

You must set the OpenShift Elasticsearch Operator to the unmanaged state to modify the following component:

- the Elasticsearch deployment files.

Explicitly unsupported cases include:

- Configuring default log rotation You cannot modify the default log rotation configuration.
- Configuring the collected log location You cannot change the location of the log collector output file, which by default is /var/log/fluentd/fluentd.log.
- **Throttling log collection**: You cannot throttle down the rate at which the logs are read in by the log collector.

- **Configuring log collection JSON parsing**: You cannot format log messages in JSON.

- **Configuring the logging collector using environment variables**: You cannot use environment variables to modify the log collector.

- **Configuring how the log collector normalizes logs**: You cannot modify default log normalization.

- **Configuring Curator in scripted deployments**: You cannot configure log curation in scripted deployments.

- **Using the Curator Action file**: You cannot use the Curator config map to modify the Curator action file.

### 4.11.3. Support policy for unmanaged Operators

The *management state* of an Operator determines whether an Operator is actively managing the resources for its related component in the cluster as designed. If an Operator is set to an *unmanaged* state, it does not respond to changes in configuration nor does it receive updates.

While this can be helpful in non-production clusters or during debugging, Operators in an unmanaged state are unsupported and the cluster administrator assumes full control of the individual component configurations and upgrades.

An Operator can be set to an unmanaged state using the following methods:

- **Individual Operator configuration**
  
  Individual Operators have a *managementState* parameter in their configuration. This can be accessed in different ways, depending on the Operator. For example, the Cluster Logging Operator accomplishes this by modifying a custom resource (CR) that it manages, while the Cluster Samples Operator uses a cluster-wide configuration resource.

  Changing the *managementState* parameter to *Unmanaged* means that the Operator is not actively managing its resources and will take no action related to the related component. Some Operators might not support this management state as it might damage the cluster and require manual recovery.

  **WARNING**

  Changing individual Operators to the *Unmanaged* state renders that particular component and functionality unsupported. Reported issues must be reproduced in *Managed* state for support to proceed.

- **Cluster Version Operator (CVO) overrides**
  
  The *spec.overrides* parameter can be added to the CVO’s configuration to allow administrators to provide a list of overrides to the CVO’s behavior for a component. Setting the *spec.overrides[].unmanaged* parameter to *true* for a component blocks cluster upgrades and alerts the administrator after a CVO override has been set:
Disabling ownership via cluster version overrides prevents upgrades. Please remove overrides before continuing.

WARNING

Setting a CVO override puts the entire cluster in an unsupported state. Reported issues must be reproduced after removing any overrides for support to proceed.
CHAPTER 5. VIEWING LOGS FOR A RESOURCE

You can view the logs for various resources, such as builds, deployments, and pods by using the OpenShift CLI (oc) and the web console.

NOTE

Resource logs are a default feature that provides limited log viewing capability. To enhance your log retrieving and viewing experience, it is recommended that you install OpenShift Logging. OpenShift Logging aggregates all the logs from your OpenShift Container Platform cluster, such as node system audit logs, application container logs, and infrastructure logs, into a dedicated log store. You can then query, discover, and visualize your log data through the Kibana interface. Resource logs do not access the OpenShift Logging log store.

5.1. VIEWING RESOURCE LOGS

You can view the log for various resources in the OpenShift CLI (oc) and web console. Logs read from the tail, or end, of the log.

Prerequisites

• Access to the OpenShift CLI (oc).

Procedure (UI)

1. In the OpenShift Container Platform console, navigate to Workloads → Pods or navigate to the pod through the resource you want to investigate.

   NOTE

   Some resources, such as builds, do not have pods to query directly. In such instances, you can locate the Logs link on the Details page for the resource.

2. Select a project from the drop-down menu.

3. Click the name of the pod you want to investigate.

4. Click Logs.

Procedure (CLI)

• View the log for a specific pod:

   $ oc logs -f <pod_name> -c <container_name>

   where:

   -f
   
   Optional: Specifies that the output follows what is being written into the logs.

   <pod_name>
   
   Specifies the name of the pod.
<container_name>

Optional: Specifies the name of a container. When a pod has more than one container, you must specify the container name.

For example:

$ oc logs ruby-58cd97df55-mww7r

$ oc logs -f ruby-57f7f4855b-znl92 -c ruby

The contents of log files are printed out.

- View the log for a specific resource:

  $ oc logs <object_type>/<resource_name>  

  Specifies the resource type and name.

For example:

$ oc logs deployment/ruby

The contents of log files are printed out.
CHAPTER 6. VIEWING CLUSTER LOGS BY USING KIBANA

OpenShift Logging includes a web console for visualizing collected log data. Currently, OpenShift Container Platform deploys the Kibana console for visualization.

Using the log visualizer, you can do the following with your data:

- search and browse the data using the Discover tab.
- chart and map the data using the Visualize tab.
- create and view custom dashboards using the Dashboard tab.

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.

NOTE

The audit logs are not stored in the internal OpenShift Container Platform Elasticsearch instance by default. To view the audit logs in Kibana, you must use the Log Forwarding API to configure a pipeline that uses the default output for audit logs.

6.1. DEFINING KIBANA INDEX PATTERNS

An index pattern defines the Elasticsearch indices that you want to visualize. To explore and visualize data in Kibana, you must create an index pattern.

Prerequisites

- A user must have the cluster-admin role, the cluster-reader role, or both roles to view the infra and audit indices in Kibana. The default kubeadmin user has proper permissions to view these indices.
  
  If you can view the pods and logs in the default, kube- and openshift- projects, you should be able to access these indices. You can use the following command to check if the current user has appropriate permissions:

  $ oc auth can-i get pods/log -n <project>

  Example output

  yes

  NOTE

  The audit logs are not stored in the internal OpenShift Container Platform Elasticsearch instance by default. To view the audit logs in Kibana, you must use the Log Forwarding API to configure a pipeline that uses the default output for audit logs.

  - Elasticsearch documents must be indexed before you can create index patterns. This is done automatically, but it might take a few minutes in a new or updated cluster.

  Procedure
To define index patterns and create visualizations in Kibana:

1. In the OpenShift Container Platform console, click the Application Launcher and select Logging.

2. Create your Kibana index patterns by clicking Management → Index Patterns → Create index pattern:
   - Each user must manually create index patterns when logging into Kibana the first time to see logs for their projects. Users must create an index pattern named app and use the @timestamp time field to view their container logs.
   - Each admin user must create index patterns when logged into Kibana the first time for the app, infra, and audit indices using the @timestamp time field.

3. Create Kibana Visualizations from the new index patterns.

6.2. VIEWING CLUSTER LOGS IN KIBANA

You view cluster logs in the Kibana web console. The methods for viewing and visualizing your data in Kibana that are beyond the scope of this documentation. For more information, refer to the Kibana documentation.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.
- Kibana index patterns must exist.

- A user must have the cluster-admin role, the cluster-reader role, or both roles to view the infra and audit indices in Kibana. The default kubeadmin user has proper permissions to view these indices. If you can view the pods and logs in the default, kube- and openshift- projects, you should be able to access these indices. You can use the following command to check if the current user has appropriate permissions:

  ```
  $ oc auth can-i get pods/log -n <project>
  ```

  Example output

  ```
  yes
  ```

  NOTE

  The audit logs are not stored in the internal OpenShift Container Platform Elasticsearch instance by default. To view the audit logs in Kibana, you must use the Log Forwarding API to configure a pipeline that uses the default output for audit logs.

Procedure

To view logs in Kibana:
1. In the OpenShift Container Platform console, click the Application Launcher and select Logging.

2. Log in using the same credentials you use to log in to the OpenShift Container Platform console.
   The Kibana interface launches.

3. In Kibana, click Discover.

4. Select the index pattern you created from the drop-down menu in the top-left corner: app, audit, or infra.
   The log data displays as time-stamped documents.

5. Expand one of the time-stamped documents.

6. Click the JSON tab to display the log entry for that document.

Example 6.1. Sample infrastructure log entry in Kibana

```json
{
  "_index": "infra-000001",
  "_type": "_doc",
  "_id": "YmJmYTBlNDkZTRmLTliMGQtMjE3NmFiOGUyOWM3",
  "_version": 1,
  "_score": null,
  "_source": {
    "docker": {
      "container_id": "f85fa55bbeb7bb783f041066be1e7c267a6b88c4603dfce213e32c1"
    },
    "kubernetes": {
      "container_name": "registry-server",
      "namespace_name": "openshift-marketplace",
      "pod_name": "redhat-marketplace-n64gc",
      "container_image": "registry.redhat.io/redhat/redhat-marketplace-index:v4.7",
      "container_image_id": "registry.redhat.io/redhat/redhat-marketplace-index@sha256:65fc0c45aabb95809e376feb065771ecda9e5e59cc8b3024c4545c168f",
      "pod_id": "8f594ea2-c866-4b5c-a1c8-a50756704b2a",
      "host": "ip-10-0-182-28.us-east-2.compute.internal",
      "master_url": "https://kubernetes.default.svc",
      "namespace_id": "3abab127-7669-4eb3-b9ef-44c04ad68d38",
      "namespace_labels": {
        "openshift_io/cluster-monitoring": "true"
      },
      "flat_labels": [
        "catalogsource_operators_coreos_com/update=redhat-marketplace"
      ]
    },
    "message": "time="2020-09-23T20:47:03Z" level=info msg="serving registry" database=/database/index.db port=50051",
    "level": "unknown",
    "hostname": "ip-10-0-182-28.internal",
    "pipeline_metadata": {
      "collector": {
        "ipaddr4": "10.0.182.28",
        "inputname": "fluent-plugin-systemd",
        "name": "fluentd",
        ""
CHAPTER 6. VIEWING CLUSTER LOGS BY USING KIBANA

"received_at": "2020-09-23T20:47:15.007583+00:00",
"version": "1.7.4 1.6.0"
}
},
"@timestamp": "2020-09-23T20:47:03.422465+00:00",
"viad_msg_id": "YmJmYTBlNDktMDMGQtMjE3NmFiOGUyOWM3",
"openshift": {
  "labels": {
    "logging": "infra"
  }
},
"fields": {
  "@timestamp": ["2020-09-23T20:47:03.422Z"],
  "pipeline_metadata.collector.received_at": [
    "2020-09-23T20:47:15.007Z"
  ],
  "sort": [1600894023422]}
}
CHAPTER 7. FORWARDING LOGS TO THIRD PARTY SYSTEMS

By default, OpenShift Logging sends container and infrastructure logs to the default internal Elasticsearch log store defined in the `ClusterLogging` custom resource. However, it does not send audit logs to the internal store because it does not provide secure storage. If this default configuration meets your needs, you do not need to configure the Cluster Log Forwarder.

To send logs to other log aggregators, you use the OpenShift Container Platform Cluster Log Forwarder. This API enables you to send container, infrastructure, and audit logs to specific endpoints within or outside your cluster. You can send different types of logs to various systems, so various individuals can access each type. You can also enable TLS support to send logs securely, as required by your organization.

**NOTE**
To send audit logs to the internal log store, use the Cluster Log Forwarder as described in Forward audit logs to the log store.

When you forward logs externally, the Cluster Logging Operator creates or modifies a Fluentd config map to send logs using your desired protocols. You are responsible for configuring the protocol on the external log aggregator.

Alternatively, you can create a config map to use the Fluentd `forward` protocol or the `syslog` protocol to send logs to external systems. However, these methods for forwarding logs are deprecated in OpenShift Container Platform and will be removed in a future release.

**IMPORTANT**
You cannot use the config map methods and the Cluster Log Forwarder in the same cluster.

7.1. ABOUT FORWARDING LOGS TO THIRD-PARTY SYSTEMS

Forwarding cluster logs to external third-party systems requires a combination of outputs and pipelines specified in a `ClusterLogForwarder` custom resource (CR) to send logs to specific endpoints inside and outside of your OpenShift Container Platform cluster. You can also use inputs to forward the application logs associated with a specific project to an endpoint.

- An **output** is the destination for log data that you define, or where you want the logs sent. An output can be one of the following types:
  - **elasticsearch**. An external Elasticsearch 6 (all releases) instance. The `elasticsearch` output can use a TLS connection.
  - **fluentdForward**. An external log aggregation solution that supports Fluentd. This option uses the Fluentd `forward` protocols. The `fluentForward` output can use a TCP or TLS connection and supports shared-key authentication by providing a `shared_key` field in a secret. Shared-key authentication can be used with or without TLS.
  - **syslog**. An external log aggregation solution that supports the syslog `RFC3164` or `RFC5424` protocols. The `syslog` output can use a UDP, TCP, or TLS connection.
  - **kafka**. A Kafka broker. The `kafka` output can use a TCP or TLS connection.
The internal OpenShift Container Platform Elasticsearch instance. You are not required to configure the default output. If you do configure a default output, you receive an error message because the default output is reserved for the Cluster Logging Operator.

If the output URL scheme requires TLS (HTTPS, TLS, or UDPS), then TLS server-side authentication is enabled. To also enable client authentication, the output must name a secret in the openshift-logging project. The secret must have keys of: tls.crt, tls.key, and ca-bundle.crt that point to the respective certificates that they represent.

- A pipeline defines simple routing from one log type to one or more outputs, or which logs you want to send. The log types are one of the following:
  - **application.** Container logs generated by user applications running in the cluster, except infrastructure container applications.
  - **infrastructure.** Container logs from pods that run in the openshift*, kube*, or default projects and journal logs sourced from node file system.
  - **audit.** Logs generated by auditd, the node audit system, and the audit logs from the Kubernetes API server and the OpenShift API server.

You can add labels to outbound log messages by using key:value pairs in the pipeline. For example, you might add a label to messages that are forwarded to others data centers or label the logs by type. Labels that are added to objects are also forwarded with the log message.

- An input forwards the application logs associated with a specific project to a pipeline.

In the pipeline, you define which log types to forward using an inputRef parameter and where to forward the logs to using an outputRef parameter.

Note the following:

- If a ClusterLogForwarder object exists, logs are not forwarded to the default Elasticsearch instance, unless there is a pipeline with the default output.

- By default, OpenShift Logging sends container and infrastructure logs to the default internal Elasticsearch log store defined in the ClusterLogging custom resource. However, it does not send audit logs to the internal store because it does not provide secure storage. If this default configuration meets your needs, do not configure the Log Forwarding API.

- If you do not define a pipeline for a log type, the logs of the undefined types are dropped. For example, if you specify a pipeline for the application and audit types, but do not specify a pipeline for the infrastructure type, infrastructure logs are dropped.

- You can use multiple types of outputs in the ClusterLogForwarder custom resource (CR) to send logs to servers that support different protocols.

- 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 Logging does not comply with those regulations.

- You are responsible for creating and maintaining any additional configurations that external destinations might require, such as keys and secrets, service accounts, port openings, or global proxy configuration.
The following example forwards the audit logs to a secure external Elasticsearch instance, the infrastructure logs to an insecure external Elasticsearch instance, the application logs to a Kafka broker, and the application logs from the my-apps-logs project to the internal Elasticsearch instance.

Sample log forwarding outputs and pipelines

```yaml
apiVersion: "logging.openshift.io/v1"
kind: ClusterLogForwarder
metadata:
  name: instance
  namespace: openshift-logging
spec:
  outputs:
  - name: elasticsearch-secure
    type: "elasticsearch"
    url: https://elasticsearch.secure.com:9200
    secret:
      name: elasticsearch
  - name: elasticsearch-insecure
    type: "elasticsearch"
    url: http://elasticsearch.insecure.com:9200
  - name: kafka-app
    type: "kafka"
    url: tls://kafka.secure.com:9093/app-topic
  inputs:
  - name: my-app-logs
    application:
      namespaces:
        - my-project
  pipelines:
  - name: audit-logs
    inputRefs:
      - audit
    outputRefs:
      - elasticsearch-secure
      - default
    labels:
      datacenter: east
      secure: true
  - name: infrastructure-logs
    inputRefs:
      - infrastructure
    outputRefs:
      - elasticsearch-insecure
    labels:
      datacenter: west
  - name: my-app
    inputRefs:
      - my-app-logs
    outputRefs:
      - default
      - inputRefs:
        - application
```
The name of the `ClusterLogForwarder` CR must be `instance`.

The namespace for the `ClusterLogForwarder` CR must be `openshift-logging`.

Configuration for an secure Elasticsearch output using a secret with a secure URL:

- A name to describe the output.
- The type of output: `elasticsearch`.
- The secure URL and port of the Elasticsearch instance as a valid absolute URL, including the prefix.
- The secret required by the endpoint for TLS communication. The secret must exist in the `openshift-logging` project.

Configuration for an insecure Elasticsearch output:

- A name to describe the output.
- The type of output: `elasticsearch`.
- The insecure URL and port of the Elasticsearch instance as a valid absolute URL, including the prefix.

Configuration for a Kafka output using a client-authenticated TLS communication over a secure URL

- A name to describe the output.
- The type of output: `kafka`.
- Specify the URL and port of the Kafka broker as a valid absolute URL, including the prefix.

Configuration for an input to filter application logs from the `my-namespace` project.

Configuration for a pipeline to send audit logs to the secure external Elasticsearch instance:

- Optional. A name to describe the pipeline.
- The `inputRefs` is the log type, in this example `audit`.
- The `outputRefs` is the name of the output to use, in this example `elasticsearch-secure` to forward to the secure Elasticsearch instance and `default` to forward to the internal Elasticsearch instance.
- Optional: Labels to add to the logs.

Configuration for a pipeline to send infrastructure logs to the insecure external Elasticsearch instance.

Configuration for a pipeline to send logs from the `my-project` project to the internal Elasticsearch instance.
Optional. A name to describe the pipeline.

The **inputRefs** is a specific input: **my-app-logs**.

The **outputRefs** is **default**.

Optional: A label to add to the logs.

Configuration for a pipeline to send logs to the Kafka broker, with no pipeline name:

- The **inputRefs** is the log type, in this example **application**.
- The **outputRefs** is the name of the output to use.
- Optional: A label to add to the logs.

**Fluentd log handling when the external log aggregator is unavailable**

If your external logging aggregator becomes unavailable and cannot receive logs, Fluentd continues to collect logs and stores them in a buffer. When the log aggregator becomes available, log forwarding resumes, including the buffered logs. If the buffer fills completely, Fluentd stops collecting logs. OpenShift Container Platform rotates the logs and deletes them. You cannot adjust the buffer size or add a persistent volume claim (PVC) to the Fluentd daemon set or pods.

### 7.2. SUPPORTED LOG DATA OUTPUT TYPES

Red Hat OpenShift Logging version 5.0 provides the following output types and protocols for sending log data to target log collectors.

Red Hat tests each of the combinations shown in the following table. However, you should be able to send log data to a wider range target log collectors that ingest these protocols.

<table>
<thead>
<tr>
<th>Output types</th>
<th>Protocols</th>
<th>Tested with</th>
</tr>
</thead>
<tbody>
<tr>
<td>fluentdForward</td>
<td>fluentd forward v1</td>
<td>fluentd 1.7.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>logstash 7.10.1</td>
</tr>
<tr>
<td>elasticsearch</td>
<td>elasticsearch</td>
<td>Elasticsearch 6.8.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elasticsearch 7.10.1</td>
</tr>
<tr>
<td>syslog</td>
<td>RFC-3164, RFC-5424</td>
<td>rsyslog 8.37.0-9.el7</td>
</tr>
<tr>
<td>kafka</td>
<td>kafka 0.11</td>
<td>kafka 2.4.1</td>
</tr>
</tbody>
</table>

**NOTE**

Previously, the syslog output supported only RFC-3164. The current syslog output adds support for RFC-5424.
7.3. FORWARDING LOGS TO AN EXTERNAL ELASTICSEARCH INSTANCE

You can optionally forward logs to an external Elasticsearch 6 (all releases) instance in addition to, or instead of, the internal OpenShift Container Platform Elasticsearch instance. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

To configure log forwarding to an external Elasticsearch instance, create a `ClusterLogForwarder` custom resource (CR) with an output to that instance and a pipeline that uses the output. The external Elasticsearch output can use the HTTP (insecure) or HTTPS (secure HTTP) connection.

To forward logs to both an external and the internal Elasticsearch instance, create outputs and pipelines to the external instance and a pipeline that uses the `default` output to forward logs to the internal instance. You do not need to create a `default` output. If you do configure a `default` output, you receive an error message because the `default` output is reserved for the Cluster Logging Operator.

**NOTE**

If you want to forward logs to only the internal OpenShift Container Platform Elasticsearch instance, you do not need to create a `ClusterLogForwarder` CR.

**Procedure**

1. Create a `ClusterLogForwarder` CR YAML file similar to the following:

   ```yaml
   apiVersion: "logging.openshift.io/v1"
   kind: ClusterLogForwarder
   metadata:
     name: instance
     namespace: openshift-logging
   spec:
     outputs:
     - name: elasticsearch-insecure
       type: "elasticsearch"
       url: http://elasticsearch.insecure.com:9200
     - name: elasticsearch-secure
       type: "elasticsearch"
       url: https://elasticsearch.secure.com:9200
       secret:
         name: es-secret
     pipelines:
     - name: application-logs
       inputRefs:
       - application
       - audit
       outputRefs:
       - elasticsearch-secure
       - default
     labels:
     - logs: application
     - name: infrastructure-audit-logs
       inputRefs:
       - infrastructure
   ```
The name of the **ClusterLogForwarder** CR must be **instance**.

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

Specify a name for the output.

Specify the **elasticsearch** type.

Specify the URL and port of the external Elasticsearch instance as a valid absolute URL. You can use the **http** (insecure) or **https** (secure HTTP) protocol. If the cluster-wide proxy using the CIDR annotation is enabled, the output must be a server name or FQDN, not an IP Address.

If using an **https** prefix, you must specify the name of the secret required by the endpoint for TLS communication. The secret must exist in the **openshift-logging** project and must have keys of: **tls.crt**, **tls.key**, and **ca-bundle.crt** that point to the respective certificates that they represent.

Optional: Specify a name for the pipeline.

Specify which log types should be forwarded using that pipeline: **application**, **infrastructure**, or **audit**.

Specify the output to use with that pipeline for forwarding the logs.

Optional: Specify the **default** output to send the logs to the internal Elasticsearch instance.

Optional: One or more labels to add to the logs.

Optional: Configure multiple outputs to forward logs to other external log aggregtors of any supported type:

- Optional. A name to describe the pipeline.

- The **inputRefs** is the log type to forward using that pipeline: **application**, **infrastructure**, or **audit**.

- The **outputRefs** is the name of the output to use.

- Optional: One or more labels to add to the logs.

2. Create the CR object:

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

The Cluster Logging Operator redeployes the Fluentd pods. If the pods do not redeploy, you can delete the Fluentd pods to force them to redeploy.

```bash
$ oc delete pod --selector logging-infra=fluentd
```
7.4. FORWARDING LOGS USING THE FLUENTD FORWARD PROTOCOL

You can use the Fluentd `forward` protocol to send a copy of your logs to an external log aggregator configured to accept the protocol instead of, or in addition to, the default Elasticsearch log store. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

To configure log forwarding using the `forward` protocol, create a `ClusterLogForwarder` custom resource (CR) with one or more outputs to the Fluentd servers and pipelines that use those outputs. The Fluentd output can use a TCP (insecure) or TLS (secure TCP) connection.

**NOTE**

Alternately, you can use a config map to forward logs using the `forward` protocols. However, this method is deprecated in OpenShift Container Platform and will be removed in a future release.

**Procedure**

1. Create a `ClusterLogForwarder` CR YAML file similar to the following:

```yaml
apiVersion: logging.openshift.io/v1
kind: ClusterLogForwarder
metadata:
  name: instance
  namespace: openshift-logging
spec:
  outputs:
    - name: fluentd-server-secure
      type: fluentdForward
      url: 'tls://fluentdserver.security.example.com:24224'
      secret: fluentd-secret
    - name: fluentd-server-insecure
      type: fluentdForward
      url: 'tcp://fluentdserver.home.example.com:24224'
  pipelines:
    - name: forward-to-fluentd-secure
      inputRefs:
        - application
        - audit
      outputRefs:
        - fluentd-server-secure
        - default
      labels:
        clusterId: C1234
    - name: forward-to-fluentd-insecure
      inputRefs:
        - infrastructure
      outputRefs:
```

---

You can use the Fluentd `forward` protocol to send a copy of your logs to an external log aggregator configured to accept the protocol instead of, or in addition to, the default Elasticsearch log store. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

To configure log forwarding using the `forward` protocol, create a `ClusterLogForwarder` custom resource (CR) with one or more outputs to the Fluentd servers and pipelines that use those outputs. The Fluentd output can use a TCP (insecure) or TLS (secure TCP) connection.

**NOTE**

Alternately, you can use a config map to forward logs using the `forward` protocols. However, this method is deprecated in OpenShift Container Platform and will be removed in a future release.

**Procedure**

1. Create a `ClusterLogForwarder` CR YAML file similar to the following:

```yaml
apiVersion: logging.openshift.io/v1
kind: ClusterLogForwarder
metadata:
  name: instance
  namespace: openshift-logging
spec:
  outputs:
    - name: fluentd-server-secure
      type: fluentdForward
      url: 'tls://fluentdserver.security.example.com:24224'
      secret: fluentd-secret
    - name: fluentd-server-insecure
      type: fluentdForward
      url: 'tcp://fluentdserver.home.example.com:24224'
  pipelines:
    - name: forward-to-fluentd-secure
      inputRefs:
        - application
        - audit
      outputRefs:
        - fluentd-server-secure
        - default
      labels:
        clusterId: C1234
    - name: forward-to-fluentd-insecure
      inputRefs:
        - infrastructure
      outputRefs:
```
The name of the **ClusterLogForwarder** CR must be `instance`.

The namespace for the **ClusterLogForwarder** CR must be `openshift-logging`.

Specify a name for the output.

Specify the **fluentdForward** type.

Specify the URL and port of the external Fluentd instance as a valid absolute URL. You can use the `tcp` (insecure) or `tls` (secure TCP) protocol. If the cluster-wide proxy using the CIDR annotation is enabled, the output must be a server name or FQDN, not an IP address.

If using a `tls` prefix, you must specify the name of the secret required by the endpoint for TLS communication. The secret must exist in the `openshift-logging` project and must have keys of: `tls.crt`, `tls.key`, and `ca-bundle.crt` that point to the respective certificates that they represent.

Optional. Specify a name for the pipeline.

Specify which log types should be forwarded using that pipeline: `application`, `infrastructure`, or `audit`.

Specify the output to use with that pipeline for forwarding the logs.

Optional. Specify the default output to forward logs to the internal Elasticsearch instance.

Optional. One or more labels to add to the logs.

Optional: Configure multiple outputs to forward logs to other external log aggregtors of any supported type:

- Optional. A name to describe the pipeline.
- The **inputRefs** is the log type to forward using that pipeline: `application`, `infrastructure`, or `audit`.
- The **outputRefs** is the name of the output to use.
- Optional: One or more labels to add to the logs.

Create the CR object:

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

The Cluster Logging Operator redeploy the Fluentd pods. If the pods do not redeploy, you can delete the Fluentd pods to force them to redeploy.

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

### 7.5. Forwarding Logs Using the Syslog Protocol
You can use the **syslog** RFC3164 or RFC5424 protocol to send a copy of your logs to an external log aggregator configured to accept the protocol instead of, or in addition to, the default Elasticsearch log store. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

To configure log forwarding using the **syslog** protocol, create a **ClusterLogForwarder** custom resource (CR) with one or more outputs to the syslog servers and pipelines that use those outputs. The syslog output can use a UDP, TCP, or TLS connection.

**NOTE**

Alternately, you can use a config map to forward logs using the **syslog** RFC3164 protocols. However, this method is deprecated in OpenShift Container Platform and will be removed in a future release.

**Procedure**

1. Create a **ClusterLogForwarder** CR YAML file similar to the following:

```yaml
apiVersion: logging.openshift.io/v1
kind: ClusterLogForwarder
metadata:
  name: instance
  namespace: openshift-logging
spec:
  outputs:
    - name: rsyslog-east
      type: syslog
      syslog:
        facility: local0
        rfc: RFC3164
        payloadKey: message
        severity: informational
        url: 'tls://rsyslogserver.east.example.com:514'
      secret:
        name: syslog-secret
    - name: rsyslog-west
      type: syslog
      syslog:
        appName: myapp
        facility: user
        msgID: mymsg
        procID: myproc
        rfc: RFC5424
        severity: debug
        url: 'udp://rsyslogserver.west.example.com:514'
  pipelines:
    - name: syslog-east
      inputRefs:
      - audit
      - application
      outputRefs:
        - rsyslog-east
        - default
```
The name of the `ClusterLogForwarder` CR must be `instance`.

The namespace for the `ClusterLogForwarder` CR must be `openshift-logging`.

Specify a name for the output.

Specify the `syslog` type.

Optional. Specify the syslog parameters, listed below.

Specify the URL and port of the external syslog instance. You can use the `udp` (insecure), `tcp` (insecure) or `tls` (secure TCP) protocol. If the cluster-wide proxy using the CIDR annotation is enabled, the output must be a server name or FQDN, not an IP address.

If using a `tls` prefix, you must specify the name of the secret required by the endpoint for TLS communication. The secret must exist in the `openshift-logging` project and must have keys of: `tls.crt`, `tls.key`, and `ca-bundle.crt` that point to the respective certificates that they represent.

Optional: Specify a name for the pipeline.

Specify which log types should be forwarded using that pipeline: `application`, `infrastructure`, or `audit`.

Specify the output to use with that pipeline for forwarding the logs.

Optional: Specify the `default` output to forward logs to the internal Elasticsearch instance.

Optional: One or more labels to add to the logs.

Optional: Configure multiple outputs to forward logs to other external log aggregtors of any supported type:

- Optional. A name to describe the pipeline.

- The `inputRefs` is the log type to forward using that pipeline: `application`, `infrastructure`, or `audit`.

- The `outputRefs` is the name of the output to use.

- Optional: One or more labels to add to the logs.

2. Create the CR object:
The Cluster Logging Operator redeploy the Fluentd pods. If the pods do not redeploy, you can delete the Fluentd pods to force them to redeploy.

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

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

### 7.5.1. Syslog parameters

You can configure the following for the `syslog` outputs. For more information, see the syslog [RFC3164](https://tools.ietf.org/html/rfc3164) or [RFC5424](https://tools.ietf.org/html/rfc5424) RFC.

- **facility**: The `syslog` facility. The value can be a decimal integer or a case-insensitive keyword:
  - 0 or `kern` for kernel messages
  - 1 or `user` for user-level messages, the default.
  - 2 or `mail` for the mail system
  - 3 or `daemon` for system daemons
  - 4 or `auth` for security/authentication messages
  - 5 or `syslog` for messages generated internally by syslogd
  - 6 or `lpr` for line printer subsystem
  - 7 or `news` for the network news subsystem
  - 8 or `uucp` for the UUCP subsystem
  - 9 or `cron` for the clock daemon
  - 10 or `authpriv` for security authentication messages
  - 11 or `ftp` for the FTP daemon
  - 12 or `ntp` for the NTP subsystem
  - 13 or `security` for the syslog audit log
  - 14 or `console` for the syslog alert log
  - 15 or `solaris-cron` for the scheduling daemon
  - 16–23 or `local0` – `local7` for locally used facilities

- Optional. **payloadKey**: The record field to use as payload for the syslog message.

**NOTE**

Configuring the `payloadKey` parameter prevents other parameters from being forwarded to the syslog.
**RFC5424** parameters

- **rfc**: The RFC to be used for sending log using syslog. The default is RFC5424.
- **severity**: The syslog severity to set on outgoing syslog records. The value can be a decimal integer or a case-insensitive keyword:
  - 0 or **Emergency** for messages indicating the system is unusable
  - 1 or **Alert** for messages indicating action must be taken immediately
  - 2 or **Critical** for messages indicating critical conditions
  - 3 or **Error** for messages indicating error conditions
  - 4 or **Warning** for messages indicating warning conditions
  - 5 or **Notice** for messages indicating normal but significant conditions
  - 6 or **Informational** for messages indicating informational messages
  - 7 or **Debug** for messages indicating debug-level messages, the default
- **tag**: Tag specifies a record field to use as tag on the syslog message.
- **trimPrefix**: Remove the specified prefix from the tag.

### 7.5.2. Additional RFC5424 syslog parameters

The following parameters apply to RFC5424:

- **appName**: The APP-NAME is a free-text string that identifies the application that sent the log. Must be specified for RFC5424.
- **msgID**: The MSGID is a free-text string that identifies the type of message. Must be specified for RFC5424.
- **procID**: The PROCID is a free-text string. A change in the value indicates a discontinuity in syslog reporting. Must be specified for RFC5424.

### 7.6. FORWARDING LOGS TO A KAFKA BROKER

You can forward logs to an external Kafka broker in addition to, or instead of, the default Elasticsearch log store.

To configure log forwarding to an external Kafka instance, create a **ClusterLogForwarder** custom resource (CR) with an output to that instance and a pipeline that uses the output. You can include a specific Kafka topic in the output or use the default. The Kafka output can use a TCP (insecure) or TLS (secure TCP) connection.

#### Procedure

1. Create a **ClusterLogForwarder** CR YAML file similar to the following:

   ```yaml
   apiVersion: logging.openshift.io/v1
   kind: ClusterLogForwarder
   metadata:
     name: instance
   ```
namespace: openshift-logging

spec:
outputs:
- name: app-logs
type: kafka
url: tls://kafka.example.devlab.com:9093/app-topic
secret:
  name: kafka-secret
- name: infra-logs
type: kafka
url: tcp://kafka.devlab2.example.com:9093/infra-topic
- name: audit-logs
type: kafka
url: tls://kafka.qelab.example.com:9093/audit-topic
secret:
  name: kafka-secret-qe

pipelines:
- name: app-topic
  inputRefs:
  - application
  outputRefs:
  - app-logs
  labels:
    logType: application
- name: infra-topic
  inputRefs:
  - infrastructure
  outputRefs:
  - infra-logs
  labels:
    logType: infra
- name: audit-topic
  inputRefs:
  - audit
  outputRefs:
  - audit-logs
  - default
  labels:
    logType: audit

The name of the **ClusterLogForwarder** CR must be **instance**.

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

Specify a name for the output.

Specify the **kafka** type.

Specify the URL and port of the Kafka broker as a valid absolute URL, optionally with a specific topic. You can use the **tcp** (insecure) or **tls** (secure TCP) protocol. If the cluster-wide proxy using the CIDR annotation is enabled, the output must be a server name or FQDN, not an IP address.

If using a **tls** prefix, you must specify the name of the secret required by the endpoint for TLS communication. The secret must exist in the **openshift-logging** project and must have keys of: `tls.crt`, `tls.key`, and `ca-bundle.crt` that point to the respective certificates.
have keys of: `tls.crt`, `tls.key`, and `ca-bundle.crt` that point to the respective certificates that they represent.

7. Optional: To send an insecure output, use a `tcp` prefix in front of the URL. Also omit the `secret` key and its `name` from this output.

8. Optional: Specify a name for the pipeline.

9. Specify which log types should be forwarded using that pipeline: `application`, `infrastructure`, or `audit`.

10. Specify the output to use with that pipeline for forwarding the logs.

11. Optional: One or more labels to add to the logs.

12. Optional: Configure multiple outputs to forward logs to other external log aggregtors of any supported type:

   - Optional. A name to describe the pipeline.

   - The `inputRefs` is the log type to forward using that pipeline: `application`, `infrastructure`, or `audit`.

   - The `outputRefs` is the name of the output to use.

   - Optional: One or more labels to add to the logs.

13. Optional: Specify `default` to forward logs to the internal Elasticsearch instance.

2. Optional: To forward a single output to multiple kafka brokers, specify an array of kafka brokers as shown in this example:

   ```yaml
   ... 
   spec:
   outputs:
   - name: app-logs
     type: kafka
     secret:
       name: kafka-secret-dev
     kafka:
       brokers:
         - tls://kafka-broker1.example.com:9093/
         - tls://kafka-broker2.example.com:9093/
     topic: app-topic
   ...
   
   1. Specify a `kafka` key that has a `brokers` and `topic` key.

   2. Use the `brokers` key to specify an array of one or more brokers.

   3. Use the `topic` key to specify the target topic that will receive the logs.

3. Create the CR object:

   ```bash
   $ oc create -f <file-name>.yaml
   ```
The Cluster Logging Operator redeloys the Fluentd pods. If the pods do not redeploy, you can delete
the Fluentd pods to force them to redeploy.

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

### 7.7. FORWARDING APPLICATION LOGS FROM SPECIFIC PROJECTS

You can use the Cluster Log Forwarder to send a copy of the application logs from specific projects to
an external log aggregator instead of, or in addition to, the default Elasticsearch log store. You are
responsible for configuring the external log aggregator to receive the logs from OpenShift Container
Platform.

To configure forwarding application logs from a project, create a `ClusterLogForwarder` custom
resource (CR) with at least one input from a project, optional outputs for other log aggregators, and
pipelines that use those inputs and outputs.

**Procedure**

1. Create a `ClusterLogForwarder` CR YAML file similar to the following:

```yaml
apiVersion: logging.openshift.io/v1
kind: ClusterLogForwarder
metadata:
  name: instance  
  namespace: openshift-logging
spec:
  outputs:
    - name: fluentd-server-secure
      type: fluentdForward
      url: 'tls://fluentdserver.security.example.com:24224'
      secret:
        name: fluentd-secret
    - name: fluentd-server-insecure
      type: fluentdForward
      url: 'tcp://fluentdserver.home.example.com:24224'
  inputs:
    - name: my-app-logs
      application:
        namespaces:
        - my-project
  pipelines:
    - name: forward-to-fluentd-insecure
      inputRefs:
      - my-app-logs
      outputRefs:
      - fluentd-server-insecure
      labels:
        project: my-project
    - name: forward-to-fluentd-secure
      inputRefs:
      - application
      - audit
```
The name of the `ClusterLogForwarder` CR must be `instance`.

The namespace for the `ClusterLogForwarder` CR must be `openshift-logging`.

Specify a name for the output.

Specify the output type: `elasticsearch`, `fluentdForward`, `syslog`, or `kafka`.

Specify the URL and port of the external log aggregator as a valid absolute URL. If the cluster-wide proxy using the CIDR annotation is enabled, the output must be a server name or FQDN, not an IP address.

If using a `tls` prefix, you must specify the name of the secret required by the endpoint for TLS communication. The secret must exist in the `openshift-logging` project and have `tls.crt`, `tls.key`, and `ca-bundle.crt` keys that each point to the certificates they represent.

Configuration for an input to filter application logs from the specified projects.

Configuration for a pipeline to use the input to send project application logs to an external Fluentd instance.

The `my-app-logs` input.

The name of the output to use.

Optional: A label to add to the logs.

Configuration for a pipeline to send logs to other log aggregators.

- Optional: Specify a name for the pipeline.
- Specify which log types should be forwarded using that pipeline: `application`, `infrastructure`, or `audit`.
- Specify the output to use with that pipeline for forwarding the logs.
- Optional: Specify the `default` output to forward logs to the internal Elasticsearch instance.
- Optional: One or more labels to add to the logs.

2. Create the CR object:

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

### 7.8. FORWARDING LOGS USING THE LEGACY FLUENTD METHOD
You can use the Fluentd `forward` protocol to send logs to destinations outside of your OpenShift Container Platform cluster by creating a configuration file and config map. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

**IMPORTANT**

This method for forwarding logs is deprecated in OpenShift Container Platform and will be removed in a future release.

To send logs using the Fluentd `forward` protocol, create a configuration file called `secure-forward.conf`, that points to an external log aggregator. Then, use that file to create a config map called `secure-forward` in the `openshift-logging` project, which OpenShift Container Platform uses when forwarding the logs.

### Sample Fluentd configuration file

```xml
<store>
  @type forward
  <security>
    self_hostname ${hostname}
    shared_key "fluent-receiver"
  </security>
  transport tls
  tls_verify_hostname false
  tls_cert_path '/etc/ocp-forward/ca-bundle.crt'
  <buffer>
    @type file
    path '/var/lib/fluentd/secureforwardlegacy'
    queued_chunks_limit_size "1024"
    chunk_limit_size "1m"
    flush_interval "5s"
    flush_at_shutdown "false"
    flush_thread_count "2"
    retry_max_interval "300"
    retry_forever true
    overflow_action "exception"
  </buffer>
  <server>
    host fluent-receiver.example.com
    port 24224
  </server>
</store>
```

### Procedure

To configure OpenShift Container Platform to forward logs using the legacy Fluentd method:

1. Create a configuration file named `secure-forward` and specify parameters similar to the following within the `<store>` stanza:

   ```xml
   <store>
     @type forward
     <security>
       self_hostname ${hostname}
       shared_key <key>
     </security>
   </store>
   ```
Enter the shared key between nodes.

Specify **tls** to enable TLS validation.

Set to **true** to verify the server cert host name. Set to **false** to ignore server cert host name.

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

Specify the **Fluentd buffer parameters** as needed.

Optionally, enter a name for this server.

Specify the host name or IP of the server.

Specify the host label of the server.

Specify the port of the server.

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

To use Mutual TLS (mTLS) authentication, see the **Fluentd documentation** for information about client certificate, key parameters, and other settings.

2. Create a config map named **secure-forward** in the **openshift-logging** project from the configuration file:
The Cluster Logging Operator redeploys the Fluentd pods. If the pods do not redeploy, you can delete the Fluentd pods to force them to redeploy.

```
$ oc create configmap secure-forward --from-file=secure-forward.conf -n openshift-logging

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

### 7.9. FORWARDING LOGS USING THE LEGACY SYSLOG METHOD

You can use the **syslog** RFC3164 protocol to send logs to destinations outside of your OpenShift Container Platform cluster by creating a configuration file and config map. You are responsible for configuring the external log aggregator to receive the logs from OpenShift Container Platform.

**IMPORTANT**

This method for forwarding logs is deprecated in OpenShift Container Platform and will be removed in a future release.

There are two versions of the **syslog** protocol:

- **out_syslog**: The non-buffered implementation, which communicates through UDP, does not buffer data and writes out results immediately.

- **out_syslog_buffered**: The buffered implementation, which communicates through TCP and buffers data into chunks.

To send logs using the **syslog** protocol, create a configuration file called **syslog.conf**, with the information needed to forward the logs. Then, use that file to create a config map called **syslog** in the **openshift-logging** project, which OpenShift Container Platform uses when forwarding the logs.

**Sample syslog configuration file**

```xml
<store>
  @type syslog_buffered
  remote_syslog rsyslogserver.example.com
  port 514
  hostname ${hostname}
  remove_tag_prefix tag
  facility local0
  severity info
  use_record true
  payload_key message
  rfc 3164
</store>
```

You can configure the following **syslog** parameters. For more information, see the syslog [RFC3164].

- **facility**: The **syslog facility**. The value can be a decimal integer or a case-insensitive keyword:
  - 0 or **kern** for kernel messages
  - 1 or **user** for user-level messages, the default.
  - 2 or **mail** for the mail system
- 3 or `daemon` for the system daemons
- 4 or `auth` for the security/authentication messages
- 5 or `syslog` for messages generated internally by syslogd
- 6 or `lpr` for the line printer subsystem
- 7 or `news` for the network news subsystem
- 8 or `uucp` for the UUCP subsystem
- 9 or `cron` for the clock daemon
- 10 or `authpriv` for security authentication messages
- 11 or `ftp` for the FTP daemon
- 12 or `ntp` for the NTP subsystem
- 13 or `security` for the syslog audit logs
- 14 or `console` for the syslog alert logs
- 15 or `solaris-cron` for the scheduling daemon
- 16–23 or `local0` – `local7` for locally used facilities

- payloadKey: The record field to use as payload for the syslog message.
- rfc: The RFC to be used for sending log using syslog.
- severity: The `syslog severity` to set on outgoing syslog records. The value can be a decimal integer or a case-insensitive keyword:
  - 0 or `Emergency` for messages indicating the system is unusable
  - 1 or `Alert` for messages indicating action must be taken immediately
  - 2 or `Critical` for messages indicating critical conditions
  - 3 or `Error` for messages indicating error conditions
  - 4 or `Warning` for messages indicating warning conditions
  - 5 or `Notice` for messages indicating normal but significant conditions
  - 6 or `Informational` for messages indicating informational messages
  - 7 or `Debug` for messages indicating debug-level messages, the default
- tag: The record field to use as tag on the syslog message.
- trimPrefix: The prefix to remove from the tag.

**Procedure**

To configure OpenShift Container Platform to forward logs using the legacy configuration methods:
1. Create a configuration file named `syslog.conf` and specify parameters similar to the following within the `<store>` stanza:

```xml
<store>
  @type <type> remote_syslog <syslog-server> port 514 hostname ${hostname} remove_tag_prefix <prefix> facility <value> severity <value> use_record <value> payload_key message rfc 3164
</store>
```

1. Specify the protocol to use, either: `syslog` or `syslog_buffered`.
2. Specify the FQDN or IP address of the syslog server.
3. Specify the port of the syslog server.
4. Optional: Specify the appropriate syslog parameters, for example:
   - Parameter to remove the specified tag field from the syslog prefix.
   - Parameter to set the specified field as the syslog key.
   - Parameter to specify the syslog log facility or source.
   - Parameter to specify the syslog log severity.
   - Parameter to use the severity and facility from the record if available. If `true`, the `container_name`, `namespace_name`, and `pod_name` are included in the output content.
   - Parameter to specify the key to set the payload of the syslog message. Defaults to `message`.
5. With the legacy syslog method, you must specify `3164` for the `rfc` value.

2. Create a config map named `syslog` in the `openshift-logging` project from the configuration file:

```
$ oc create configmap syslog --from-file=syslog.conf -n openshift-logging
```

The Cluster Logging Operator redeploys the Fluentd pods. If the pods do not redeploy, you can delete the Fluentd pods to force them to redeploy.

```
$ oc delete pod --selector logging-infra=fluentd
```
CHAPTER 8. COLLECTING AND STORING KUBERNETES EVENTS

The OpenShift Container Platform Event Router is a pod that watches Kubernetes events and logs them for collection by OpenShift Logging. You must manually deploy the Event Router.

The Event Router collects events from all projects and writes them to STDOUT. Fluentd collects those events and forwards them into the OpenShift Container Platform Elasticsearch instance. Elasticsearch indexes the events to the infra index.

IMPORTANT

The Event Router adds additional load to Fluentd and can impact the number of other log messages that can be processed.

8.1. DEPLOYING AND CONFIGURING THE EVENT ROUTER

Use the following steps to deploy the Event Router into your cluster. You should always deploy the Event Router to the openshift-logging project to ensure it collects events from across the cluster.

The following Template object creates the service account, cluster role, and cluster role binding required for the Event Router. The template also configures and deploys the Event Router pod. You can use this template without making changes, or change the deployment object CPU and memory requests.

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.

- OpenShift Logging must be installed.

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 OpenShift 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
      namespace: ${NAMESPACE}
```
- 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
- 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:
        requests:
          cpu: ${CPU}
1. Creates a Service Account in the `openshift-logging` project for the Event Router.
2. Creates a ClusterRole to monitor for events in the cluster.
3. Creates a ClusterRoleBinding to bind the ClusterRole to the service account.
4. Creates a config map in the `openshift-logging` project to generate the required `config.json` file.
5. Creates a deployment in the `openshift-logging` project to generate and configure the Event Router pod.
6. Specifies the minimum amount of memory to allocate to the Event Router pod. Defaults to 128Mi.
7. Specifies the minimum amount of CPU to allocate to the Event Router pod. Defaults to 100m.
8. Specifies the `openshift-logging` project to install objects in.

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

```bash
$ oc process -f <templatefile> | oc apply -n openshift-logging -f -
```

For example:

```bash
$ oc process -f eventrouter.yaml | oc apply -n openshift-logging -f -
```

**Example output**

```
serviceaccount/logging-eventrouter created
clusterrole.authorization.openshift.io/event-reader created
```
3. Validate that the Event Router installed in the openshift-logging project:
   a. View the new Event Router pod:

   ```bash
   $ oc get pods --selector component=eventrouter -o name -n openshift-logging
   pod/cluster-logging-eventrouter-d649f97c8-qvv8r
   
   Example output
   
   pod/cluster-logging-eventrouter-d649f97c8-qvv8r
   
   $ oc logs <cluster_logging_eventrouter_pod> -n openshift-logging
   
   For example:

   ```bash
   $ oc logs cluster-logging-eventrouter-d649f97c8-qvv8r -n openshift-logging
   ```

   
   Example output

   ```json
   ```

   You can also use Kibana to view events by creating an index pattern using the Elasticsearch infra index.
CHAPTER 9. UPDATING OPENSSHIFT LOGGING

After updating the OpenShift Container Platform cluster from 4.6 to 4.7, you can update the OpenShift Elasticsearch Operator and Cluster Logging Operator from 4.6 to 5.0.

9.1. UPDATING OPENSSHIFT LOGGING

After updating the OpenShift Container Platform cluster, you can update from cluster logging 4.6 to Red Hat OpenShift Logging 5.0 by changing the subscription for the OpenShift Elasticsearch Operator and the Cluster Logging Operator.

When you update:

- You must update the OpenShift Elasticsearch Operator before updating the Cluster Logging Operator.
- You must update both the OpenShift Elasticsearch Operator and the Cluster Logging Operator. Kibana is unusable when the OpenShift Elasticsearch Operator has been updated but the Cluster Logging Operator has not been updated.

If you update the Cluster Logging Operator before the OpenShift Elasticsearch Operator, Kibana does not update and the Kibana custom resource (CR) is not created. To work around this problem, delete the Cluster Logging Operator pod. When the Cluster Logging Operator pod redeploys, the Kibana CR is created.

IMPORTANT

Upgrade your cluster logging version to 4.6 before updating to Red Hat OpenShift Logging 5.0.

Prerequisites

- Update the OpenShift Container Platform cluster from 4.6 to 4.7.
- Make sure the OpenShift Logging status is healthy:
  - All pods are ready.
  - The Elasticsearch cluster is healthy.
- Back up your Elasticsearch and Kibana data.

Procedure

1. Update the OpenShift Elasticsearch Operator:
   a. From the web console, click Operators → Installed Operators.
   b. Select the openshift-operators-redhat project.
   c. Click the OpenShift Elasticsearch Operator.
   d. Click Subscription → Channel.
   e. In the Change Subscription Update Channel window, select 5.0 and click Save.
f. Wait for a few seconds, then click **Operators → Installed Operators**. Verify that the OpenShift Elasticsearch Operator version is 5.0.x.

   Wait for the **Status** field to report **Succeeded**.

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 **5.0** and click **Save**.

f. Wait for a few seconds, then click **Operators → Installed Operators**. Verify that the Cluster Logging Operator version is 5.0.x.

   Wait for the **Status** field to report **Succeeded**.

3. Check the logging components:

a. Ensure that all Elasticsearch pods are in the **Ready** status:

   ```bash
   $ oc get pod -n openshift-logging --selector component=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-1pbrl44l-1-55b7546f4c-mshhk</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>31m</td>
</tr>
<tr>
<td>elasticsearch-cdm-1pbrl44l-2-5c6d87589f-gx5hk</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>30m</td>
</tr>
<tr>
<td>elasticsearch-cdm-1pbrl44l-3-88df5d47-m45jc</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>29m</td>
</tr>
</tbody>
</table>
   
   Example output
   ```

b. Ensure that the Elasticsearch cluster is healthy:

   ```bash
   $ oc exec -n openshift-logging -c elasticsearch elasticsearch-cdm-1pbrl44l-1-55b7546f4c-mshhk -- es_cluster_health
   
   ```

   ```json
   
   { "cluster_name" : "elasticsearch", "status" : "green", 
   
   }....
   ```

b. Ensure that the Elasticsearch cron jobs are created:

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

<table>
<thead>
<tr>
<th>NAME</th>
<th>SCHEDULE</th>
<th>SUSPEND</th>
<th>ACTIVE</th>
<th>LAST SCHEDULE</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>elasticsearch-im-app</td>
<td>*/15 * * * *</td>
<td>False</td>
<td>0</td>
<td>&lt;none&gt;</td>
<td>56s</td>
</tr>
</tbody>
</table>
```
Verify that the log store is updated to 5.0 and the indices are **green**:

```
$ oc exec -c elasticsearch <any_es_pod_in_the_cluster> -- indices
```

Verify that the output includes the **app-00000x, infra-00000x, audit-00000x, .security** indices.

### Example 9.1. Sample output with indices in a green status

```bash
tue Jun 30 14:30:54 UTC 2020
health status index          uuid                   pri rep
docs.count docs.deleted store.size pri.store.size
green open infra-000008
bnBvUFEXTWii92z3zWAzieQ 3 1  222195     0   289   144
green open infra-000004
rtDSzqqsSl6saisSK7Au1Q 3 1  226717     0   297   148
green open infra-000012
RS1_kUwDSR2xEuKRZMPqZQ 3 1  227623     0   295   147
green open .kibana_7
1SJdCqZTPWiiAaOud78yg 1 1  248368     0   317   158
green open infra-000010
iXwl3bqnTuGEAbBuDa6OVw 3 1  258799     0   337   168
green open infra-000009
YN9EsULWSNaxWeeNVoSoRA 3 1  223788     0   292   146
green open infra-000015
YP0U6R7FQ_GVQVQZ6Yh9Ig 3 1  224371     0   291   145
green open .orphaned.2020.06.30
n_xQC2dWzConkvQqe3YA 3 1  228584     0   296   148
```

OpenShift Container Platform 4.7 Logging
Verify that the log collector is updated to 5.0:

```
$ oc get ds fluentd -o json | grep fluentd-init
```
Verify that the output includes a fluentd-init container:

```
"containerName": "fluentd-init"
```

Verify that the log visualizer is updated to 5.0 using the Kibana CRD:

```
$ oc get kibana kibana -o json
```
Verify that the output includes a Kibana pod with the ready status:

```json
[{
  "clusterCondition": {
    "kibana-5fdd766ffd-nb2jj": [
      {
        "lastTransitionTime": "2020-06-30T14:11:07Z",
        "reason": "ContainerCreating",
        "status": "True",
        "type": ""
      },
      {
        "lastTransitionTime": "2020-06-30T14:11:07Z",
        "reason": "ContainerCreating",
        "status": "True",
        "type": ""
      }
    ],
    "deployment": "kibana",
    "pods": {
      "failed": [],
      "notReady": [],
      "ready": []
    },
    "replicaSets": [
      "kibana-5fdd766ffd"
    ],
    "replicas": 1
  }
}]
```
g. Verify the Curator is updated to 5.0:

```
$ oc get cronjob -o name
```

```
cronjob.batch/curator
cronjob.batch/elasticsearch-delete-app
cronjob.batch/elasticsearch-delete-audit
cronjob.batch/elasticsearch-deleteinfra
cronjob.batch/elasticsearch-rollover-app
cronjob.batch/elasticsearch-rollover-audit
cronjob.batch/elasticsearch-rolloverinfra
```

Verify that the output includes the `elasticsearch-delete-*` and `elasticsearch-rollover-*` indices.
CHAPTER 10. VIEWING CLUSTER DASHBOARDS

The **Logging/Elasticsearch Nodes** and **Openshift Logging** dashboards in the OpenShift Container Platform web console show in-depth details about your Elasticsearch instance and the individual Elasticsearch nodes that you can use to prevent and diagnose problems.

The **Openshift Logging** dashboard contains charts that show details about your Elasticsearch instance at a cluster level, including cluster resources, garbage collection, shards in the cluster, and Fluentd statistics.

The **Logging/Elasticsearch Nodes** dashboard contains charts that show details about your Elasticsearch instance, many at node level, including details on indexing, shards, resources, and so forth.

**NOTE**
For more detailed data, click the **Grafana UI** link in a dashboard to launch the Grafana dashboard. Grafana is shipped with **OpenShift cluster monitoring**.

10.1. ACCESSING THE ELASTISEARCH AND OPENSHPIFT LOGGING DASHBOARDS

You can view the **Logging/Elasticsearch Nodes** and **Openshift Logging** dashboards in the OpenShift Container Platform web console.

**Procedure**

To launch the dashboards:

1. In the OpenShift Container Platform web console, click **Monitoring → Dashboards**.

2. On the **Dashboards** page, select **Logging/Elasticsearch Nodes** or **Openshift Logging** from the **Dashboard** menu.
   
   For the **Logging/Elasticsearch Nodes** dashboard, you can select the Elasticsearch node you want to view and set the data resolution.
   
   The appropriate dashboard is displayed, showing multiple charts of data.

3. Optionally, select a different time range to display or refresh rate for the data from the **Time Range** and **Refresh Interval** menus.

   **NOTE**
   For more detailed data, click the **Grafana UI** link to launch the Grafana dashboard.

For information on the dashboard charts, see **About the OpenShift Logging dashboard** and **About the Logging/Elasticsearch Nodes dashboard**.

10.2. ABOUT THE OPENSHPIFT LOGGING DASHBOARD

The **Openshift Logging** dashboard contains charts that show details about your Elasticsearch instance at a cluster-level that you can use to diagnose and anticipate problems.

**Table 10.1. OpenShift Logging charts**
<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic Cluster Status</td>
<td>The current Elasticsearch status:</td>
</tr>
<tr>
<td></td>
<td>- ONLINE - Indicates that the Elasticsearch instance is online.</td>
</tr>
<tr>
<td></td>
<td>- OFFLINE - Indicates that the Elasticsearch instance is offline.</td>
</tr>
<tr>
<td>Elastic Nodes</td>
<td>The total number of Elasticsearch nodes in the Elasticsearch instance.</td>
</tr>
<tr>
<td>Elastic Shards</td>
<td>The total number of Elasticsearch shards in the Elasticsearch instance.</td>
</tr>
<tr>
<td>Elastic Documents</td>
<td>The total number of Elasticsearch documents in the Elasticsearch instance.</td>
</tr>
<tr>
<td>Total Index Size on Disk</td>
<td>The total disk space that is being used for the Elasticsearch indices.</td>
</tr>
<tr>
<td>Elastic Pending Tasks</td>
<td>The total number of Elasticsearch changes that have not been completed, such as index creation, index mapping, shard allocation, or shard failure.</td>
</tr>
<tr>
<td>Elastic JVM GC time</td>
<td>The amount of time that the JVM spent executing Elasticsearch garbage collection operations in the cluster.</td>
</tr>
<tr>
<td>Elastic JVM GC Rate</td>
<td>The total number of times that JVM executed garbage activities per second.</td>
</tr>
<tr>
<td>Elastic Query/Fetch Latency Sum</td>
<td>* Query latency: The average time each Elasticsearch search query takes to execute.</td>
</tr>
<tr>
<td></td>
<td>* Fetch latency: The average time each Elasticsearch search query spends fetching data.</td>
</tr>
<tr>
<td></td>
<td>Fetch latency typically takes less time than query latency. If fetch latency is consistently increasing, it might indicate slow disks, data enrichment, or large requests with too many results.</td>
</tr>
<tr>
<td>Elastic Query Rate</td>
<td>The total queries executed against the Elasticsearch instance per second for each Elasticsearch node.</td>
</tr>
<tr>
<td>CPU</td>
<td>The amount of CPU used by Elasticsearch, Fluentd, and Kibana, shown for each component.</td>
</tr>
</tbody>
</table>
### Elastic JVM Heap Used
The amount of JVM memory used. In a healthy cluster, the graph shows regular drops as memory is freed by JVM garbage collection.

### Elasticsearch Disk Usage
The total disk space used by the Elasticsearch instance for each Elasticsearch node.

### File Descriptors In Use
The total number of file descriptors used by Elasticsearch, Fluentd, and Kibana.

### FluentD emit count
The total number of Fluentd messages per second for the Fluentd default output, and the retry count for the default output.

### FluentD Buffer Availability
The percent of the Fluentd buffer that is available for chunks. A full buffer might indicate that Fluentd is not able to process the number of logs received.

### Elastic rx bytes
The total number of bytes that Elasticsearch has received from FluentD, the Elasticsearch nodes, and other sources.

### Elastic Index Failure Rate
The total number of times per second that an Elasticsearch index fails. A high rate might indicate an issue with indexing.

### FluentD Output Error Rate
The total number of times per second that FluentD is not able to output logs.

### 10.3. CHARTS ON THE LOGGING/ELASTICSEARCH NODES DASHBOARD
The **Logging/Elasticsearch Nodes** dashboard contains charts that show details about your Elasticsearch instance, many at node-level, for further diagnostics.

#### Elasticsearch status
The **Logging/Elasticsearch Nodes** dashboard contains the following charts about the status of your Elasticsearch instance.

#### Table 10.2. Elasticsearch status fields

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic JVM Heap Used</td>
<td>The amount of JVM memory used. In a healthy cluster, the graph shows regular drops as memory is freed by JVM garbage collection.</td>
</tr>
<tr>
<td>Elasticsearch Disk Usage</td>
<td>The total disk space used by the Elasticsearch instance for each Elasticsearch node.</td>
</tr>
<tr>
<td>File Descriptors In Use</td>
<td>The total number of file descriptors used by Elasticsearch, Fluentd, and Kibana.</td>
</tr>
<tr>
<td>FluentD emit count</td>
<td>The total number of Fluentd messages per second for the Fluentd default output, and the retry count for the default output.</td>
</tr>
<tr>
<td>FluentD Buffer Availability</td>
<td>The percent of the Fluentd buffer that is available for chunks. A full buffer might indicate that Fluentd is not able to process the number of logs received.</td>
</tr>
<tr>
<td>Elastic rx bytes</td>
<td>The total number of bytes that Elasticsearch has received from FluentD, the Elasticsearch nodes, and other sources.</td>
</tr>
<tr>
<td>Elastic Index Failure Rate</td>
<td>The total number of times per second that an Elasticsearch index fails. A high rate might indicate an issue with indexing.</td>
</tr>
<tr>
<td>FluentD Output Error Rate</td>
<td>The total number of times per second that FluentD is not able to output logs.</td>
</tr>
</tbody>
</table>
### Cluster status

The cluster health status during the selected time period, using the Elasticsearch green, yellow, and red statuses:

- **0** - Indicates that the Elasticsearch instance is in green status, which means that all shards are allocated.
- **1** - Indicates that the Elasticsearch instance is in yellow status, which means that replica shards for at least one shard are not allocated.
- **2** - Indicates that the Elasticsearch instance is in red status, which means that at least one primary shard and its replicas are not allocated.

### Cluster nodes

The total number of Elasticsearch nodes in the cluster.

### Cluster data nodes

The number of Elasticsearch data nodes in the cluster.

### Cluster pending tasks

The number of cluster state changes that are not finished and are waiting in a cluster queue, for example, index creation, index deletion, or shard allocation. A growing trend indicates that the cluster is not able to keep up with changes.

### Elasticsearch cluster index shard status

Each Elasticsearch index is a logical group of one or more shards, which are basic units of persisted data. There are two types of index shards: primary shards, and replica shards. When a document is indexed into an index, it is stored in one of its primary shards and copied into every replica of that shard. The number of primary shards is specified when the index is created, and the number cannot change during index lifetime. You can change the number of replica shards at any time.

The index shard can be in several states depending on its lifecycle phase or events occurring in the cluster. When the shard is able to perform search and indexing requests, the shard is active. If the shard cannot perform these requests, the shard is non-active. A shard might be non-active if the shard is initializing, reallocating, unassigned, and so forth.

Index shards consist of a number of smaller internal blocks, called index segments, which are physical representations of the data. An index segment is a relatively small, immutable Lucene index that is created when Lucene commits newly-indexed data. Lucene, a search library used by Elasticsearch, merges index segments into larger segments in the background to keep the total number of segments low. If the process of merging segments is slower than the speed at which new segments are created, it could indicate a problem.

When Lucene performs data operations, such as a search operation, Lucene performs the operation against the index segments in the relevant index. For that purpose, each segment contains specific data structures that are loaded in the memory and mapped. Index mapping can have a significant impact on the memory used by segment data structures.
The Logging/Elasticsearch Nodes dashboard contains the following charts about the Elasticsearch index shards.

Table 10.3. Elasticsearch cluster shard status charts

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster active shards</td>
<td>The number of active primary shards and the total number of shards, including replicas, in the cluster. If the number of shards grows higher, the cluster performance can start degrading.</td>
</tr>
<tr>
<td>Cluster initializing shards</td>
<td>The number of non-active shards in the cluster. A non-active shard is one that is initializing, being reallocated to a different node, or is unassigned. A cluster typically has non-active shards for short periods. A growing number of non-active shards over longer periods could indicate a problem.</td>
</tr>
<tr>
<td>Cluster relocating shards</td>
<td>The number of shards that Elasticsearch is relocating to a new node. Elasticsearch relocates nodes for multiple reasons, such as high memory use on a node or after a new node is added to the cluster.</td>
</tr>
<tr>
<td>Cluster unassigned shards</td>
<td>The number of unassigned shards. Elasticsearch shards might be unassigned for reasons such as a new index being added or the failure of a node.</td>
</tr>
</tbody>
</table>

Elasticsearch node metrics

Each Elasticsearch node has a finite amount of resources that can be used to process tasks. When all the resources are being used and Elasticsearch attempts to perform a new task, Elasticsearch put the tasks into a queue until some resources become available.

The Logging/Elasticsearch Nodes dashboard contains the following charts about resource usage for a selected node and the number of tasks waiting in the Elasticsearch queue.

Table 10.4. Elasticsearch node metric charts

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ThreadPool tasks</td>
<td>The number of waiting tasks in individual queues, shown by task type. A long-term accumulation of tasks in any queue could indicate node resource shortages or some other problem.</td>
</tr>
<tr>
<td>CPU usage</td>
<td>The amount of CPU being used by the selected Elasticsearch node as a percentage of the total CPU allocated to the host container.</td>
</tr>
<tr>
<td>Memory usage</td>
<td>The amount of memory being used by the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Disk usage</td>
<td>The total disk space being used for index data and metadata on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Documents indexing rate</td>
<td>The rate that documents are indexed on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Indexing latency</td>
<td>The time taken to index the documents on the selected Elasticsearch node. Indexing latency can be affected by many factors, such as JVM Heap memory and overall load. A growing latency indicates a resource capacity shortage in the instance.</td>
</tr>
<tr>
<td>Search rate</td>
<td>The number of search requests run on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Search latency</td>
<td>The time taken to complete search requests on the selected Elasticsearch node. Search latency can be affected by many factors. A growing latency indicates a resource capacity shortage in the instance.</td>
</tr>
<tr>
<td>Documents count (with replicas)</td>
<td>The number of Elasticsearch documents stored on the selected Elasticsearch node, including documents stored in both the primary shards and replica shards that are allocated on the node.</td>
</tr>
<tr>
<td>Documents deleting rate</td>
<td>The number of Elasticsearch documents being deleted from any of the index shards that are allocated to the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Documents merging rate</td>
<td>The number of Elasticsearch documents being merged in any of index shards that are allocated to the selected Elasticsearch node.</td>
</tr>
</tbody>
</table>

**Elasticsearch node fielddata**

Fielddata is an Elasticsearch data structure that holds lists of terms in an index and is kept in the JVM Heap. Because fielddata building is an expensive operation, Elasticsearch caches the fielddata structures. Elasticsearch can evict a fielddata cache when the underlying index segment is deleted or merged, or if there is not enough JVM HEAP memory for all the fielddata caches.

The **Logging/Elasticsearch Nodes** dashboard contains the following charts about Elasticsearch fielddata.

**Table 10.5. Elasticsearch node fielddata charts**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fielddata memory size</td>
<td>The amount of JVM Heap used for the fielddata cache on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Fielddata evictions</td>
<td>The number of fielddata structures that were deleted from the selected Elasticsearch node.</td>
</tr>
</tbody>
</table>

**Elasticsearch node query cache**

If the data stored in the index does not change, search query results are cached in a node–level query cache for reuse by Elasticsearch.

The **Logging/Elasticsearch Nodes** dashboard contains the following charts about the Elasticsearch node query cache.

Table 10.6. Elasticsearch node query charts

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query cache size</td>
<td>The total amount of memory used for the query cache for all the shards allocated to the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Query cache evictions</td>
<td>The number of query cache evictions on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Query cache hits</td>
<td>The number of query cache hits on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>Query cache misses</td>
<td>The number of query cache misses on the selected Elasticsearch node.</td>
</tr>
</tbody>
</table>

**Elasticsearch index throttling**

When indexing documents, Elasticsearch stores the documents in index segments, which are physical representations of the data. At the same time, Elasticsearch periodically merges smaller segments into a larger segment as a way to optimize resource use. If the indexing is faster than the ability to merge segments, the merge process does not complete quickly enough, which can lead to issues with searches and performance. To prevent this situation, Elasticsearch throttles indexing, typically by reducing the number of threads allocated to indexing down to a single thread.

The **Logging/Elasticsearch Nodes** dashboard contains the following charts about Elasticsearch index throttling.

Table 10.7. Index throttling charts

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indexing throttling</td>
<td>The amount of time that Elasticsearch has been throttling the indexing operations on the selected Elasticsearch node.</td>
</tr>
</tbody>
</table>
Merging throttling

The amount of time that Elasticsearch has been throttling the segment merge operations on the selected Elasticsearch node.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merging throttling</td>
<td>The amount of time that Elasticsearch has been throttling the segment merge operations on the selected Elasticsearch node.</td>
</tr>
</tbody>
</table>

Node JVM Heap statistics

The **Logging/Elasticsearch Nodes** dashboard contains the following charts about JVM Heap operations.

### Table 10.8. JVM Heap statistic charts

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heap used</td>
<td>The amount of the total allocated JVM Heap space that is used on the selected Elasticsearch node.</td>
</tr>
<tr>
<td>GC count</td>
<td>The number of garbage collection operations that have been run on the selected Elasticsearch node, by old and young garbage collection.</td>
</tr>
<tr>
<td>GC time</td>
<td>The amount of time that the JVM spent running garbage collection operations on the selected Elasticsearch node, by old and young garbage collection.</td>
</tr>
</tbody>
</table>
CHAPTER 11. TROUBLESHOOTING LOGGING

11.1. VIEWING OPENSIFT LOGGING STATUS

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

11.1.1. Viewing the status of the Cluster Logging Operator

You can view the status of your Cluster Logging Operator.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

Procedure

1. Change to the openshift-logging project.

   $ oc project openshift-logging

2. To view the OpenShift Logging status:

   a. Get the OpenShift Logging status:

      $ oc get clusterlogging instance -o yaml

Example output

```
apiVersion: logging.openshift.io/v1
kind: ClusterLogging
....
status: 1
  collection:
    logs:
      fluentdStatus:
        daemonSet: fluentd 2
        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
```
In the output, the cluster status fields appear in the **status** stanza.

Information on the Fluentd pods.

Information on the Elasticsearch pods, including Elasticsearch cluster health, **green**, **yellow**, or **red**.

Information on the Kibana pods.
11.1.1. Example condition messages

The following are examples of some condition messages from the `Status.Nodes` section of the OpenShift 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:

**Example output**

```
- conditions:
    message: Disk storage usage for node is 27.5gb (36.74%). Shards will 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:

**Example output**

```
- conditions:
  - lastTransitionTime: 2019-03-15T15:04:45Z
    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:

**Example output**

```
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**:
  - Message: **0/5 nodes are available: 5 node(s) didn't match node selector.**
  - Reason: **Unschedulable**
  - Status: **True**
  - Type: **Unschedulable**

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

**Example output**

Node Conditions:
- **elasticsearch-cdm-mkkdys93-1**:
  - 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 Fluentd pods cannot be scheduled because the node selector did not match any nodes:

**Example output**

Status:
- Collection:
- Logs:
  - Fluentd Status:
    - Daemon Set: fluentd
- Nodes:
- Pods:
11.1.2. Viewing the status of OpenShift Logging components

You can view the status for a number of OpenShift Logging components.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

Procedure

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

   $ oc project openshift-logging

2. View the status of the OpenShift Logging environment:

   $ oc describe deployment cluster-logging-operator

   **Example output**

   Name:                   cluster-logging-operator
   ....

   Conditions:
   Type           Status       Reason
   ----           ------       -----
   Available      True         MinimumReplicasAvailable
   Progressing    True         NewReplicaSetAvailable
   ....

   Events:
   Type    Reason                   Age   From            Message
   ----    ------                   ----   ----            -------
   Normal  ScalingReplicaSet       62m   deployment-controller  Scaled up replica set cluster-logging-operator-574b8987df to 1----

3. View the status of the OpenShift Logging replica set:

   a. Get the name of a replica set:

       **Example output**

       $ oc get replicaset

       **Example output**

       NAME          DESIRED CURRENT READY AGE
b. Get the status of the replica set:

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

**Example output**

```
Name:           cluster-logging-operator-574b8987df
....
Replicas:       1 current / 1 desired
Pods Status:    1 Running / 0 Waiting / 0 Succeeded / 0 Failed
....
Events:
  Type    Reason            Age   From                   Message
  ----    ------            ----  ----                   -------
  Normal  SuccessfulCreate  66m   replicaset-controller  Created pod: cluster-logging-operator-574b8987df-qjhqv----
```

### 11.2. VIEWING THE STATUS OF THE LOG STORE

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

#### 11.2.1. Viewing the status of the log store

You can view the status of your log store.

**Prerequisites**

- OpenShift Logging and Elasticsearch must be installed.

**Procedure**

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

   
   `$ oc project openshift-logging`

2. To view the status:

   a. Get the name of the log store instance:

      
      `$ oc get Elasticsearch`

   **Example output**
b. Get the log store 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:

**Example output**

```
status:
  cluster:
    activePrimaryShards: 30
    activeShards: 60
    initializingShards: 0
    numDataNodes: 3
    numNodes: 3
    pendingTasks: 0
    relocatingShards: 0
    status: green
    unassignedShards: 0
    clusterHealth: "" 
  conditions: []
  nodes:
    - deploymentName: elasticsearch-cdm-zjf34ved-1
      upgradeStatus: {}
    - deploymentName: elasticsearch-cdm-zjf34ved-2
      upgradeStatus: {}
    - deploymentName: elasticsearch-cdm-zjf34ved-3
      upgradeStatus: {}
  pods:
    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:
```

---

1. NAME: elasticsearch, AGE: 5h9m
2. status: 1, cluster: 2
3. conditions: []
4. nodes: 4
5. pods: 5
In the output, the cluster status fields appear in the `status` stanza.

The status of the log store:

- The number of active primary shards.
- The number of active shards.
- The number of shards that are initializing.
- The number of log store data nodes.
- The total number of log store nodes.
- The number of pending tasks.
- The log store status: `green`, `red`, `yellow`.
- The number of unassigned shards.

Any status conditions, if present. The log store 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 log store and proxy containers.
- Container Terminated for both the log store and proxy containers.
- Pod unschedulable. Also, a condition is shown for a number of issues, see Example condition messages.

The log store nodes in the cluster, with `upgradeStatus`.

The log store client, data, and master pods in the cluster, listed under `failed`, `notReady` or `ready` state.

### 11.2.1.1. 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 not be allocated on this node.
        reason: Disk Watermark Low
```
This status message indicates a node has exceeded the configured high watermark and shards will be relocated to other nodes.

```
status: "True"
type: NodeStorage
deploymentName: example-elasticsearch-cdm-0-1
upgradeStatus: {}
```

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

```
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 log store CR uses a non-existent PVC.

```
status:
  nodes:
    - conditions:
      - lastTransitionTime: 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 log store cluster does not have enough nodes to support your log store 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
```

CHAPTER 11. TROUBLESHOOTING LOGGING

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

```
reason: Invalid Settings
status: "True"
type: InvalidRedundancy
```

11.2.2. Viewing the status of the log store components

You can view the status for a number of the log store components.

Elasticsearch indices

You can view the status of the Elasticsearch indices.

1. Get the name of an Elasticsearch pod:

```bash
$ oc get pods --selector component=elasticsearch -o name
```

**Example output**

```
pod/elasticsearch-cdm-1godmszn-1-6f8495-vc4w4
pod/elasticsearch-cdm-1godmszn-2-5769cf-9ms2n
pod/elasticsearch-cdm-1godmszn-3-f66f7d-zqkz7
```

2. Get the status of the indices:

```bash
$ oc exec elasticsearch-cdm-4vjor49p-2-6d4d7db474-q2w7z -- indices
```

**Example output**

Defaulting container name to elasticsearch.
Use 'oc describe pod/elasticsearch-cdm-4vjor49p-2-6d4d7db474-q2w7z -n openshift-logging' to see all of the containers in this pod.

```
green  open   infra-000002                                                     S4QANnf1QP6NgCegfnrnbQ
  3 1 119926  0 157  78

green  open   audit-000001                                                     8_EQx77iQCSTzFOXtxRqFw
  3 1 0 0 0 0

green  open   .security                                                        iDjscH7aSUGhIdq0LheLBQ  1
  1 5 0 0 0

green  open   .kibana_-377444158_kubeadmin yBywZ9GfSrKebz5gWBZbjw  3 1 1 0 0 0

green  open   infra-000001                                                     z6Dpe__ORgiopEpW6YI44A
```

---

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Log store pods

You can view the status of the pods that host the log store.

1. Get the name of a pod:

   ```bash
   $ 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:

   ```bash
   $ oc describe pod elasticsearch-cdm-1godmszn-1-6f8495-vp4lw
   ```

   The output includes the following status information:

   **Example output**

   ```text
   ....
   Status: Running
   ....

   Containers:
   elasticsearch:
   Container ID: cri-o://b7d44e0a9ea486e27f47763f5bb4c39dfd2
   State: Running
   Started: Mon, 08 Jun 2020 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:
   Container ID: cri-o://3f77032abaddbb1652c116278652908dc01860380b8a4e741d06894b2f8f9aa1
   State: Running
   Started: Mon, 08 Jun 2020 10:18:38 -0400
   Ready: True
   Restart Count: 0
   ```
Log storage pod deployment configuration

You can view the status of the log store deployment configuration.

1. Get the name of a deployment configuration:

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

**Example output**

   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:

**Example output**

   Containers:
     elasticsearch:
       Image: registry.redhat.io/openshift-logging/elasticsearch6-rhel8
       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

   Events: <none>
Log store replica set
You can view the status of the log store replica set.

1. Get the name of a replica set:

   $ 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:

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

   The output includes the following status information:

   Example output

   ....
   Containers:
   elasticsearch:
   Image: registry.redhat.io/openshift-logging/elasticsearch6-rhel8@sha256:4265742c7cdd85359140e2d7d703e4311b6497ee7676957f455d6908e7bc25
   Readiness: exec [/usr/share/elasticsearch/probe/readiness.sh] delay=10s timeout=30s period=5s #success=1 #failure=3
   ....
   Events: <none>

11.3. UNDERSTANDING OPENSFIGHT LOGGING ALERTS

All of the logging collector alerts are listed on the Alerting UI of the OpenShift Container Platform web console.

11.3.1. Viewing logging collector alerts

Alerts are shown in the OpenShift Container Platform web console, on the Alerts tab of the Alerting UI. 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.

Procedure

To view OpenShift Logging and other OpenShift Container Platform alerts:
1. In the OpenShift Container Platform console, click Monitoring → Alerting.

2. Click the Alerts tab. The alerts are listed, based on the filters selected.

**Additional resources**

- For more information on the Alerting UI, see Managing alerts.

### 11.3.2. About logging collector alerts

The following alerts are generated by the logging collector. You can view these alerts in the OpenShift Container Platform web console, on the Alerts page of the Alerting UI.

**Table 11.1. Fluentd Prometheus alerts**

<table>
<thead>
<tr>
<th>Alert</th>
<th>Message</th>
<th>Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>FluentDHighErrorRate</td>
<td>&lt;value&gt; of records have resulted in an error by fluentd &lt;instance&gt;.</td>
<td>The number of FluentD output errors is high, by default more than 10 in the previous 15 minutes.</td>
<td>Warning</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>FluentdQueueLengthBurst</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 cannot keep up with the data being indexed.</td>
<td>Warning</td>
</tr>
<tr>
<td>FluentdQueueLengthIncreasing</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 that the queue size is increasing.</td>
<td>Critical</td>
</tr>
<tr>
<td>FluentDVeryHighErrorRate</td>
<td>&lt;value&gt; of records have resulted in an error by fluentd &lt;instance&gt;.</td>
<td>The number of FluentD output errors is very high, by default more than 25 in the previous 15 minutes.</td>
<td>Critical</td>
</tr>
</tbody>
</table>

### 11.3.3. 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>The cluster health status has been RED for at least 2 minutes. The cluster does not accept writes, shards may be missing, or the master node hasn’t been elected yet.</td>
<td>critical</td>
</tr>
<tr>
<td>ElasticsearchClusterNotHealthy</td>
<td>The cluster health status has been YELLOW for at least 20 minutes. Some shard replicas are not allocated.</td>
<td>warning</td>
</tr>
<tr>
<td>ElasticsearchDiskSpaceRunningLow</td>
<td>The cluster is expected to be out of disk space within the next 6 hours.</td>
<td>Critical</td>
</tr>
<tr>
<td>ElasticsearchHighFileDescriptorUse</td>
<td>The cluster is predicted to be out of file descriptors within the next hour.</td>
<td>warning</td>
</tr>
<tr>
<td>ElasticsearchJVMHeapUseHigh</td>
<td>The JVM Heap usage on the specified node is high.</td>
<td>Alert</td>
</tr>
<tr>
<td>ElasticsearchNodeDiskWatermarkReached</td>
<td>The specified node has hit the low watermark due to low free disk space. Shards can not be allocated to this node anymore. You should consider adding more disk space to the node.</td>
<td>info</td>
</tr>
<tr>
<td>ElasticsearchNodeDiskWatermarkReached</td>
<td>The specified node has hit the high watermark due to low free disk space. 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>warning</td>
</tr>
<tr>
<td>ElasticsearchNodeDiskWatermarkReached</td>
<td>The specified node has hit the flood watermark due to low free disk space. Every index that has a shard allocated on this node is enforced a read-only block. The index block must be manually released when the disk use falls below the high watermark.</td>
<td>critical</td>
</tr>
<tr>
<td>ElasticsearchJVMHeapUseHigh</td>
<td>The JVM Heap usage on the specified node is too high.</td>
<td>alert</td>
</tr>
<tr>
<td>ElasticsearchWriteRequestsRejectionJumps</td>
<td>Elasticsearch is experiencing an increase in write rejections on the specified node. This node might not be keeping up with the indexing speed.</td>
<td>warning</td>
</tr>
<tr>
<td>AggregatedLoggingSystemCPUTHigh</td>
<td>The CPU used by the system on the specified node is too high.</td>
<td>alert</td>
</tr>
<tr>
<td>ElasticsearchProcessCPUTHigh</td>
<td>The CPU used by Elasticsearch on the specified node is too high.</td>
<td>alert</td>
</tr>
</tbody>
</table>

### 11.4. TROUBLESHOOTING THE LOG CURATOR

You can use information in this section for debugging log curation. Curator is used to remove data that is in the Elasticsearch index format prior to OpenShift Container Platform 4.7, and will be removed in a later release.
11.4.1. Troubleshooting log curation

You can use information in this section for debugging log curation. For example, if curator is in a 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

- OpenShift Logging and Elasticsearch must be installed.

Procedure

To enable the Curator debug log and trigger next Curator iteration manually:

1. Enable debug log of Curator:

   ```
   $ 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**

   OpenShift 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.

2. Trigger next curator iteration:

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

3. Use the following commands to control the cron job:

   - **Suspend a cron job**:
     ```
     $ oc patch cronjob curator -p '{"spec":{"suspend":true}}'
     ```
   - **Resume a cron job**:
     ```
     $ oc patch cronjob curator -p '{"spec":{"suspend":false}}'
     ```
   - **Change a cron job schedule**:
11.5. COLLECTING LOGGING DATA FOR RED HAT SUPPORT

When opening a support case, it is helpful to provide debugging information about your cluster to Red Hat Support.

The must-gather tool enables you to collect diagnostic information for project-level resources, cluster-level resources, and each of the OpenShift Logging components.

For prompt support, supply diagnostic information for both OpenShift Container Platform and OpenShift Logging.

**NOTE**

Do not use the hack/logging-dump.sh script. The script is no longer supported and does not collect data.

11.5.1. About the must-gather tool

The oc adm must-gather CLI command collects the information from your cluster that is most likely needed for debugging issues.

For your OpenShift Logging environment, must-gather collects the following information:

- project-level resources, including pods, configuration maps, service accounts, roles, role bindings, and events at the project level
- cluster-level resources, including nodes, roles, and role bindings at the cluster level
- OpenShift Logging resources in the openshift-logging and openshift-operators-redhat namespaces, including health status for the log collector, the log store, the curator, and the log visualizer

When you run oc adm must-gather, a new pod is created on the cluster. The data is collected on that pod and saved in a new directory that starts with must-gather.local. This directory is created in the current working directory.

11.5.2. Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

11.5.3. Collecting OpenShift Logging data

You can use the oc adm must-gather CLI command to collect information about your OpenShift Logging environment.

**Procedure**

To collect OpenShift Logging information with must-gather:

1. Navigate to the directory where you want to store the must-gather information.

```bash
$ oc patch cronjob curator -p '{"spec":{"schedule":"0 0 * * *"}}'
```

The schedule option accepts schedules in cron format.
2. Run the `oc adm must-gather` command against the OpenShift Logging image:

   ```bash
   $ oc adm must-gather --image=$(oc -n openshift-logging get deployment.apps/cluster-logging-operator -o jsonpath='{.spec.template.spec.containers[?(@.name == "cluster-logging-operator")].image}')
   
   The `must-gather` tool creates a new directory that starts with `must-gather.local` within the current directory. For example: `must-gather.local.4157245944708210408`.

3. Create a compressed file from the `must-gather` directory that was just created. For example, on a computer that uses a Linux operating system, run the following command:

   ```bash
   $ tar -cvaf must-gather.tar.gz must-gather.local.4157245944708210408
   
   4. Attach the compressed file to your support case on the Red Hat Customer Portal.
CHAPTER 12. UNINSTALLING OPENSHIFT LOGGING

You can remove OpenShift Logging from your OpenShift Container Platform cluster.

12.1. UNINSTALLING OPENSHIFT LOGGING FROM OPENSHIFT CONTAINER PLATFORM

You can stop log aggregation by deleting the ClusterLogging custom resource (CR). After deleting the CR, there are other OpenShift Logging components that remain, which you can optionally remove.

Deleting the ClusterLogging CR does not remove the persistent volume claims (PVCs). To preserve or delete the remaining PVCs, persistent volumes (PVs), and associated data, you must take further action.

Prerequisites

- OpenShift Logging and Elasticsearch must be installed.

Procedure

To remove OpenShift Logging:

1. Use the OpenShift Container Platform web console to remove the ClusterLogging CR:
   a. Switch to the Administration → Custom Resource Definitions page.
   c. On the Custom Resource Definition Details page, click Instances.
   d. Click the Options menu next to the instance and select Delete ClusterLogging.

2. Optional: Delete the custom resource definitions (CRD):
   a. Switch to the Administration → Custom Resource Definitions page.
   b. Click the Options menu next to ClusterLogForwarder and select Delete Custom Resource Definition.
   c. Click the Options menu next to ClusterLogging and select Delete Custom Resource Definition.
   d. Click the Options menu next to Elasticsearch and select Delete Custom Resource Definition.

3. Optional: Remove the Cluster Logging Operator and OpenShift Elasticsearch Operator:
   a. Switch to the Operators → Installed Operators page.
b. Click the Options menu next to the Cluster Logging Operator and select **Uninstall Operator**.

c. Click the Options menu next to the OpenShift Elasticsearch Operator and select **Uninstall Operator**.

4. Optional: Remove the OpenShift Logging and Elasticsearch projects.

   a. Switch to the **Home → Projects** page.

   b. Click the Options menu next to the **openshift-logging** project and select **Delete Project**.

   c. Confirm the deletion by typing **openshift-logging** in the dialog box and click **Delete**.

   d. Click the Options menu next to the **openshift-operators-redhat** project and select **Delete Project**.

   **IMPORTANT**

   Do not delete the **openshift-operators-redhat** project if other global operators are installed in this namespace.

   e. Confirm the deletion by typing **openshift-operators-redhat** in the dialog box and click **Delete**.

5. To keep the PVCs for reuse with other pods, keep the labels or PVC names that you need to reclaim the PVCs.

6. Optional: If you do not want to keep the PVCs, you can delete them.

   a. Switch to the **Storage → Persistent Volume Claims** page.

   b. Click the Options menu next to each PVC and select **Delete Persistent Volume Claim**.

   c. If you want to recover storage space, you can delete the PVs.

   **WARNING**

   Releasing or deleting PVCs can delete PVs and cause data loss.
Additional resources

- Reclaiming a persistent volume manually
CHAPTER 13. 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

13.1. 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>
</tbody>
</table>
### Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<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. 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>. Numeric values from syslog/journal PRIORITY can usually be mapped using the priority values as listed at <code>misc/sys/syslog.h</code>. 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 syslog APP-NAME 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 its 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                  |
## Parameter Description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.processes.ps_vm`                    | type: integer  
The `collectd ps_vm` type of processes plug-in.                          |
| `collectd.processes.ps_rss`                   | type: integer  
The `collectd ps_rss` type of processes plug-in.                          |
| `collectd.processes.ps_data`                  | type: integer  
The `collectd ps_data` type of processes plug-in.                          |
| `collectd.processes.ps_code`                  | type: integer  
The `collectd ps_code` type of processes plug-in.                          |
| `collectd.processes.ps_stacksize`             | type: integer  
The `collectd ps_stacksize` type of processes plug-in.                     |

### `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>
</table>
| `collectd.processes.ps_cputime.user`          | type: float  
TODO                                                                                             |
| `collectd.processes.ps_cputime.syst`          | type: float  
TODO                                                                                             |

### `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>
</table>
| `collectd.processes.ps_count.processes`       | type: integer  
TODO                                                                                             |
| `collectd.processes.ps_count.threads`         | type: integer  
TODO                                                                                             |

### `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 |
### collectd.disk Fields
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>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>if_octets.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>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>if_packets.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>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>if_errors.rx</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>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>
<tbody>
<tr>
<td>collectd.interface.if_dropped.rx</td>
<td>type: float TODO</td>
</tr>
<tr>
<td>collectd.interface.if_dropped.tx</td>
<td>type: float TODO</td>
</tr>
</tbody>
</table>

### 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>
<tbody>
<tr>
<td>collectd.virt.if_octets.rx</td>
<td>type: float TODO</td>
</tr>
<tr>
<td>collectd.virt.if_octets.tx</td>
<td>type: float TODO</td>
</tr>
</tbody>
</table>

### 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>
<tbody>
<tr>
<td>collectd.virt.if_packets.rx</td>
<td>type: float TODO</td>
</tr>
<tr>
<td>collectd.virt.if_packets.tx</td>
<td>type: float TODO</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.virt.disk_octets.read</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
<tr>
<td>collectd.virt.disk_octets.write</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>
</tbody>
</table>
| `collectd.virt.memory`    | type: float  
The `collectd` memory type of virt plug-in.                                                                                             |
| `collectd.virt.vcpu`      | type: float  
The `collectd vcpu` type of virt plug-in.                                                                                              |
| `collectd.virt.vcpu_total`| type: float  
The `collectd vcpu_total` type of virt plug-in.                                                                                     |

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.CPU.percent`    | type: float  
The `collectd` type percent of plug-in CPU.                                                                                               |

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| `collectd.df.df_complex`  | type: float  
The `collectd` type `df_complex` of plug-in `df`.                                                                                            |
| `collectd.df.percent_bytes`| type: float  
The `collectd` type `percent_bytes` of plug-in `df`.                                                                                   |

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

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

**collectd.memory Fields**  
Corresponds to the `collectd` memory plug-in.
### collectd.memory
- **collectd.memory.memory**
  - Type: float
  - Description: The collectd memory type of memory plug-in.

- **collectd.memory.percent**
  - Type: float
  - Description: 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>
<tbody>
<tr>
<td>collectd.swap.swap</td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The collectd swap type of swap plug-in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.swap.swap_io</td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The collectd swap_io type of swap plug-in.</td>
</tr>
</tbody>
</table>

### 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>
<tbody>
<tr>
<td>collectd.load.load.shortterm</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.load.load midterm</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.load.load longterm</td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>TODO</td>
</tr>
</tbody>
</table>

### collectd.aggregation
**Fields**
Corresponds to collectd aggregation plug-in.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>collectd.aggregation.perc</code></td>
<td>type: float</td>
</tr>
<tr>
<td></td>
<td>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><code>collectd.statsd.host_cpu</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> CPU type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_elapsed_time</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd elapsed_time</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_memory</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd</code> memory type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_nic_speed</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_speed</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_nic_rx</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_rx</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_nic_tx</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_tx</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_nic_rx_dropped</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_rx_dropped</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_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.host_nic_rx_errors</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_rx_errors</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><code>collectd.statsd.host_nic_tx_errors</code></td>
<td>type: integer</td>
</tr>
<tr>
<td></td>
<td>The <code>collectd nic_tx_errors</code> type of <code>statsd</code> plug-in.</td>
</tr>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| collectd.statsd.host_storage | type: integer  
The `collectd` storage type of `statsd` plug-in. |
| collectd.statsd.host_swap | type: integer  
The `collectd` swap type of `statsd` plug-in. |
| collectd.statsd.host_vds | type: integer  
The `collectd` VDSM type of `statsd` plug-in. |
| collectd.statsd.host_vms | type: integer  
The `collectd` VMS type of `statsd` plug-in. |
| collectd.statsd.vm_nic_tx_dropped | type: integer  
The `collectd nic_tx_dropped` type of `statsd` plug-in. |
| collectd.statsd.vm_nic_rx_bytes | type: integer  
The `collectd nic_rx_bytes` type of `statsd` plug-in. |
| collectd.statsd.vm_nic_tx_bytes | type: integer  
The `collectd nic_tx_bytes` type of `statsd` plug-in. |
| collectd.statsd.vm_balloon_min | type: integer  
The `collectd balloon_min` type of `statsd` plug-in. |
| collectd.statsd.vm_balloon_max | type: integer  
The `collectd balloon_max` type of `statsd` plug-in. |
| collectd.statsd.vm_balloon_target | type: integer  
The `collectd balloon_target` type of `statsd` plug-in. |
| collectd.statsd.vm_balloon_cur | type: integer  
The `collectd balloon_cur` type of `statsd` plug-in. |
| collectd.statsd.vm_cpu_sys | type: integer  
The `collectd cpu_sys` type of `statsd` plug-in. |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>collectd.statsd.vm_cpu_usage</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>collectd.statsd.vm_disk_read_ops</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>collectd.statsd.vm_disk_write_ops</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>collectd.statsd.vm_disk_flush_latency</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>collectd.statsd.vm_disk_apparent_size</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>collectd.statsd.vm_disk_write_bytes</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>collectd.statsd.vm_disk_write_rate</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>collectd.statsd.vm_disk_true_size</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>collectd.statsd.vm_disk_read_rate</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>collectd.statsd.vm_disk_write_latency</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>collectd.statsd.vm_disk_read_latency</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>collectd.statsd.vm_disk_read_bytes</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** **pg_n_tup_g** of plug-in **postgresql**. |
| collectd.postgresql.pg_n_tup_c | type: integer  
The **collectd** **pg_n_tup_c** of plug-in **postgresql**. |
| collectd.postgresql.pg_numbackends | type: integer  
The **collectd** **pg_numbackends** of plug-in **postgresql**. |
| collectd.postgresql.pg_xact | type: integer  
The **collectd** **pg_xact** of plug-in **postgresql**. |
| collectd.postgresql.pg_db_size | type: integer  
The **collectd** **pg_db_size** of plug-in **postgresql**. |
| collectd.postgresql.pg_blks | type: integer  
The **collectd** **pg_blks** of plug-in **postgresql**. |
13.2. SYSTEMD EXPORTED FIELDS

These are the **systemd** fields exported by OpenShift 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.KERNELDEVICE</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_SYSNAME</td>
<td><strong>systemd.k.UDEV_SYSNAME</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.BOOTT_ID</td>
<td><strong>systemd.t.BOOTT_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><code>systemd.t.EXE</code> is the executable path of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.GID</td>
<td><code>systemd.t.GID</code> is the group ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.HOSTNAME</td>
<td><code>systemd.t.HOSTNAME</code> is the name of the host.</td>
</tr>
<tr>
<td>systemd.t.MACHINE_ID</td>
<td><code>systemd.t.MACHINE_ID</code> is the machine ID of the host.</td>
</tr>
<tr>
<td>systemd.t.PID</td>
<td><code>systemd.t.PID</code> is the process ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SELINUX_CONTEXT</td>
<td><code>systemd.t.SELINUX_CONTEXT</code> is the security context, or label, for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SOURCE_REALTIME_TIMESTAMP</td>
<td><code>systemd.t.SOURCE_REALTIME_TIMESTAMP</code> 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><code>systemd.t.SYSTEMD_CGROUP</code> is the <code>systemd</code> control group path.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_OWNER_UID</td>
<td><code>systemd.t.SYSTEMD_OWNER_UID</code> is the owner ID of the session.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_SESSION</td>
<td><code>systemd.t.SYSTEMD_SESSION</code> is applicable, is the <code>systemd</code> session ID.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_SLICE</td>
<td><code>systemd.t.SYSTEMD_SLICE</code> is the slice unit of the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_UNIT</td>
<td><code>systemd.t.SYSTEMD_UNIT</code> is the unit name for a session.</td>
</tr>
<tr>
<td>systemd.t.SYSTEMD_USER_UNIT</td>
<td><code>systemd.t.SYSTEMD_USER_UNIT</code>, if applicable, is the user unit name for a session.</td>
</tr>
<tr>
<td>systemd.t.TRANSPORT</td>
<td><code>systemd.t.TRANSPORT</code> is the method of entry by the journal service. This includes, <code>audit</code>, <code>driver</code>, <code>syslog</code>, <code>journal</code>, <code>stdout</code>, and <code>kernel</code>.</td>
</tr>
<tr>
<td>systemd.t.UID</td>
<td><code>systemd.t.UID</code> is the user ID for the journal entry process.</td>
</tr>
<tr>
<td>systemd.t.SYSLOG_FACILITY</td>
<td><code>systemd.t.SYSLOG_FACILITY</code> is the field containing the facility, formatted as a decimal string, for <code>syslog</code>.</td>
</tr>
<tr>
<td>systemd.t.SYSLOG_IDENTIFIER</td>
<td><code>systemd.t.systemd.t.SYSLOG_IDENTIFIER</code> is the identifier for <code>syslog</code>.</td>
</tr>
</tbody>
</table>
systemd.t.SYSLOG_PID | 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>systemd.u.CODE_FILE</td>
<td><strong>systemd.u.CODE_FILE</strong> is the code location containing the filename of the source.</td>
</tr>
<tr>
<td>systemd.u.CODE_FUNCTION</td>
<td><strong>systemd.u.CODE_FUNCTION</strong> is the code location containing the function of the source.</td>
</tr>
<tr>
<td>systemd.u.CODE_LINE</td>
<td><strong>systemd.u.CODE_LINE</strong> is the code location containing the line number of the source.</td>
</tr>
<tr>
<td>systemd.u.ERRNO</td>
<td><strong>systemd.u.ERRNO</strong>, if present, is the low-level error number formatted in numeric value, as a decimal string.</td>
</tr>
<tr>
<td>systemd.u.MESSAGE_ID</td>
<td><strong>systemd.u.MESSAGE_ID</strong> is the message identifier ID for recognizing message types.</td>
</tr>
<tr>
<td>systemd.u.RESULT</td>
<td>For private use only.</td>
</tr>
<tr>
<td>systemd.u.UNIT</td>
<td>For private use only.</td>
</tr>
</tbody>
</table>

### 13.3. KUBERNETES EXPORTED FIELDS

These are the Kubernetes fields exported by OpenShift 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>kubernetes.pod_id</td>
<td>Kubernetes ID of the pod.</td>
</tr>
<tr>
<td>kubernetes.namespace_name</td>
<td>The name of the namespace in Kubernetes.</td>
</tr>
<tr>
<td>kubernetes.namespace_id</td>
<td>ID of the namespace in Kubernetes.</td>
</tr>
</tbody>
</table>
### kubernetes.annotations Fields
Annotations associated with the OpenShift object are `kubernetes.annotations` fields.

<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>

### 13.4. CONTAINER EXPORTED FIELDS
These are the Docker fields exported by OpenShift 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>
The log message was received by the collector whether it was TCP/UDP, or imjournal/imfile.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pipeline_metadata.collect or.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.collect or.received_at</td>
<td>Time when the message was received by the collector.</td>
</tr>
<tr>
<td>pipeline_metadata.collect or.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.normal izer.hostname</td>
<td>FQDN of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.name</td>
<td>Name of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.version</td>
<td>Version of the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.ipaddr4</td>
<td>IP address v4 of the normalizer server, can be an array.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.ipaddr6</td>
<td>IP address v6 of the normalizer server, can be an array.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.inputname</td>
<td>how the log message was received by the normalizer whether it was TCP/UDP.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.received_at</td>
<td>Time when the message was received by the normalizer.</td>
</tr>
<tr>
<td>pipeline_metadata.normal izer.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>

**13.5. OVIRT EXPORTED FIELDS**
These are the oVirt fields exported by OpenShift 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`

13.6. AUSHAPE EXPORTED FIELDS
These are the Aushape fields exported by OpenShift 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>
13.7. TLOG EXPORTED FIELDS

These are the Tlog fields exported by the OpenShift 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><code>aushape.data.obj_pid</code></td>
<td>type: nested</td>
</tr>
<tr>
<td><code>aushape.data.path</code></td>
<td>type: nested</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>tlog.ver</code></td>
<td>Message format version number.</td>
</tr>
<tr>
<td><code>tlog.user</code></td>
<td>Recorded user name.</td>
</tr>
<tr>
<td><code>tlog.term</code></td>
<td>Terminal type name.</td>
</tr>
<tr>
<td><code>tlog.session</code></td>
<td>Audit session ID of the recorded session.</td>
</tr>
<tr>
<td><code>tlog.id</code></td>
<td>ID of the message within the session.</td>
</tr>
<tr>
<td><code>tlog.pos</code></td>
<td>Message position in the session, milliseconds.</td>
</tr>
<tr>
<td><code>tlog.timing</code></td>
<td>Distribution of this message's events in time.</td>
</tr>
<tr>
<td><code>tlog.in_txt</code></td>
<td>Input text with invalid characters scrubbed.</td>
</tr>
<tr>
<td><code>tlog.in_bin</code></td>
<td>Scrubbed invalid input characters as bytes.</td>
</tr>
<tr>
<td><code>tlog.out_txt</code></td>
<td>Output text with invalid characters scrubbed.</td>
</tr>
<tr>
<td><code>tlog.out_bin</code></td>
<td>Scrubbed invalid output characters as bytes.</td>
</tr>
</tbody>
</table>