OpenShift Container Platform 4.5

Authentication and authorization

Configuring user authentication and access controls for users and services

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Configuring user authentication and access controls for users and services

Legal Notice

Abstract

This document provides instructions for defining identity providers in OpenShift Container Platform. It also discusses how to configure role-based access control to secure the cluster.

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CHAPTER 1. UNDERSTANDING AUTHENTICATION

For users to interact with OpenShift Container Platform, they must first authenticate to the cluster. The authentication layer identifies the user associated with requests to the OpenShift Container Platform API. The authorization layer then uses information about the requesting user to determine if the request is allowed.

As an administrator, you can configure authentication for OpenShift Container Platform.

1.1. USERS

A *user* in OpenShift Container Platform is an entity that can make requests to the OpenShift Container Platform API. An OpenShift Container Platform **User** object represents an actor which can be granted permissions in the system by adding roles to them or to their groups. Typically, this represents the account of a developer or administrator that is interacting with OpenShift Container Platform.

Several types of users can exist:

User type	Description
Regular users	This is the way most interactive OpenShift Container Platform users are represented. Regular users are created automatically in the system upon first login or can be created via the API. Regular users are represented with the **User** object. Examples: **joe alice**
System users	Many of these are created automatically when the infrastructure is defined, mainly for the purpose of enabling the infrastructure to interact with the API securely. They include a cluster administrator (with access to everything), a per-node user, users for use by routers and registries, and various others. Finally, there is an **anonymous** system user that is used by default for unauthenticated requests. Examples: **system:admin system:openshift-registry system:node:node1.example.com**
Service accounts	These are special system users associated with projects; some are created automatically when the project is first created, while project administrators can create more for the purpose of defining access to the contents of each project. Service accounts are represented with the **ServiceAccount** object. Examples: **system:serviceaccount:default:deployer system:serviceaccount:foo:builder**

Each user must authenticate in some way in order to access OpenShift Container Platform. API requests with no authentication or invalid authentication are authenticated as requests by the **anonymous** system user. Once authenticated, policy determines what the user is authorized to do.

1.2. GROUPS

A user can be assigned to one or more *groups*, each of which represent a certain set of users. Groups are useful when managing authorization policies to grant permissions to multiple users at once, for example allowing access to objects within a project, versus granting them to users individually.

In addition to explicitly defined groups, there are also system groups, or *virtual groups*, that are automatically provisioned by the cluster.

The following default virtual groups are most important:

Virtual group	Description
system:authenticated	Automatically associated with all authenticated users.
system:authenticated:oauth	Automatically associated with all users authenticated with an OAuth access token.
system:unauthenticated	Automatically associated with all unauthenticated users.

1.3. API AUTHENTICATION

Requests to the OpenShift Container Platform API are authenticated using the following methods:

OAuth access tokens

- Obtained from the OpenShift Container Platform OAuth server using the ***<namespace_route>*/oauth/authorize** and ***<namespace_route>*/oauth/token** endpoints.
- Sent as an **Authorization: Bearer…** header.
- Sent as a websocket subprotocol header in the form **base64url.bearer.authorization.k8s.io.<base64url-encoded-token>** for websocket requests.

X.509 client certificates

- Requires an HTTPS connection to the API server.
- Verified by the API server against a trusted certificate authority bundle.
- The API server creates and distributes certificates to controllers to authenticate themselves.

Any request with an invalid access token or an invalid certificate is rejected by the authentication layer with a **401** error.

If no access token or certificate is presented, the authentication layer assigns the **system:anonymous** virtual user and the **system:unauthenticated** virtual group to the request. This allows the authorization layer to determine which requests, if any, an anonymous user is allowed to make.

1.3.1. OpenShift Container Platform OAuth server

The OpenShift Container Platform master includes a built-in OAuth server. Users obtain OAuth access tokens to authenticate themselves to the API.

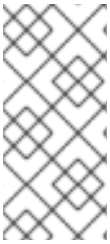
When a person requests a new OAuth token, the OAuth server uses the configured identity provider to determine the identity of the person making the request.

It then determines what user that identity maps to, creates an access token for that user, and returns the token for use.

1.3.1.1. OAuth token requests

Every request for an OAuth token must specify the OAuth client that will receive and use the token. The following OAuth clients are automatically created when starting the OpenShift Container Platform API:

OAuth Client	Usage
openshift-browser-client	Requests tokens at ***<namespace_route>*/oauth/token/request** with a user-agent that can handle interactive logins.
openshift-challenging-client	Requests tokens with a user-agent that can handle **WWW-Authenticate** challenges.



NOTE

<namespace_route> refers to the namespace's route. This is found by running the following command.

```
$ oc get route oauth-openshift -n openshift-authentication -o json | jq .spec.host
```

All requests for OAuth tokens involve a request to ***<namespace_route>*/oauth/authorize**. Most authentication integrations place an authenticating proxy in front of this endpoint, or configure OpenShift Container Platform to validate credentials against a backing identity provider. Requests to ***<namespace_route>*/oauth/authorize** can come from user-agents that cannot display interactive login pages, such as the CLI. Therefore, OpenShift Container Platform supports authenticating using a **WWW-Authenticate** challenge in addition to interactive login flows.

If an authenticating proxy is placed in front of the ***<namespace_route>*/oauth/authorize** endpoint, it sends unauthenticated, non-browser user-agents **WWW-Authenticate** challenges rather than displaying an interactive login page or redirecting to an interactive login flow.

NOTE

To prevent cross-site request forgery (CSRF) attacks against browser clients, only send Basic authentication challenges with if a **X-CSRF-Token** header is on the request. Clients that expect to receive Basic **WWW-Authenticate** challenges must set this header to a non-empty value.

If the authenticating proxy cannot support **WWW-Authenticate** challenges, or if OpenShift Container Platform is configured to use an identity provider that does not support WWW-Authenticate challenges, you must use a browser to manually obtain a token from ***<namespace_route>*/oauth/token/request**.

1.3.1.2. API impersonation

You can configure a request to the OpenShift Container Platform API to act as though it originated from another user. For more information, see User impersonation in the Kubernetes documentation.

1.3.1.3. Authentication metrics for Prometheus

OpenShift Container Platform captures the following Prometheus system metrics during authentication attempts:

- **openshift_auth_basic_password_count** counts the number of **oc login** user name and password attempts.
- **openshift_auth_basic_password_count_result** counts the number of **oc login** user name and password attempts by result, **success** or **error**.
- **openshift_auth_form_password_count** counts the number of web console login attempts.
- **openshift_auth_form_password_count_result** counts the number of web console login attempts by result, **success** or **error**.
- **openshift_auth_password_total** counts the total number of **oc login** and web console login attempts.

CHAPTER 2. CONFIGURING THE INTERNAL OAUTH SERVER

2.1. OPENSHIFT CONTAINER PLATFORM OAUTH SERVER

The OpenShift Container Platform master includes a built-in OAuth server. Users obtain OAuth access tokens to authenticate themselves to the API.

When a person requests a new OAuth token, the OAuth server uses the configured identity provider to determine the identity of the person making the request.

It then determines what user that identity maps to, creates an access token for that user, and returns the token for use.

2.2. OAUTH TOKEN REQUEST FLOWS AND RESPONSES

The OAuth server supports standard authorization code grant and the implicit grant OAuth authorization flows.

When requesting an OAuth token using the implicit grant flow (**response_type=token**) with a client_id configured to request **WWW-Authenticate challenges** (like **openshift-challenging-client**), these are the possible server responses from **/oauth/authorize**, and how they should be handled:

Status	Content	Client response
302	**Location** header containing an **access_token** parameter in the URL fragment (RFC 6749 section 4.2.2)	Use the **access_token** value as the OAuth token.
302	**Location** header containing an **error** query parameter (RFC 6749 section 4.1.2.1)	Fail, optionally surfacing the **error** (and optional **error_description**) query values to the user.
302	Other **Location** header	Follow the redirect, and process the result using these rules.
401	**WWW-Authenticate** header present	Respond to challenge if type is recognized (e.g. **Basic**, **Negotiate**, etc), resubmit request, and process the result using these rules.
401	**WWW-Authenticate** header missing	No challenge authentication is possible. Fail and show response body (which might contain links or details on alternate methods to obtain an OAuth token).
Other	Other	Fail, optionally surfacing response body to the user.

2.3. OPTIONS FOR THE INTERNAL OAUTH SERVER

Several configuration options are available for the internal OAuth server.

2.3.1. OAuth token duration options

The internal OAuth server generates two kinds of tokens:

Token	Description
Access tokens	Longer-lived tokens that grant access to the API.
Authorize codes	Short-lived tokens whose only use is to be exchanged for an access token.

You can configure the default duration for both types of token. If necessary, you can override the duration of the access token by using an **OAuthClient** object definition.

2.3.2. OAuth grant options

When the OAuth server receives token requests for a client to which the user has not previously granted permission, the action that the OAuth server takes is dependent on the OAuth client's grant strategy.

The OAuth client requesting token must provide its own grant strategy.

You can apply the following default methods:

Grant option	Description
auto	Auto-approve the grant and retry the request.
prompt	Prompt the user to approve or deny the grant.

2.4. CONFIGURING THE INTERNAL OAUTH SERVER'S TOKEN DURATION

You can configure default options for the internal OAuth server's token duration.

IMPORTANT

By default, tokens are only valid for 24 hours. Existing sessions expire after this time elapses.

If the default time is insufficient, then this can be modified using the following procedure.

Procedure

1. Create a configuration file that contains the token duration options. The following file sets this to 48 hours, twice the default.

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
```

```
spec:
  tokenConfig:
    accessTokenMaxAgeSeconds: 172800 (1)
```

(1) Set **accessTokenMaxAgeSeconds** to control the lifetime of access tokens. The default lifetime is 24 hours, or 86400 seconds. This attribute cannot be negative. If set to zero, the default lifetime is used.

2. Apply the new configuration file:

NOTE

Because you update the existing OAuth server, you must use the **oc apply** command to apply the change.

```
$ oc apply -f </path/to/file.yaml>
```

3. Confirm that the changes are in effect:

```
$ oc describe oauth.config.openshift.io/cluster
```

Example output

```
...
Spec:
  Token Config:
    Access Token Max Age Seconds:  172800
...
```

2.5. REGISTER AN ADDITIONAL OAUTH CLIENT

If you need an additional OAuth client to manage authentication for your OpenShift Container Platform cluster, you can register one.

Procedure

- To register additional OAuth clients:

```
$ oc create -f <(echo '
kind: OAuthClient
apiVersion: oauth.openshift.io/v1
metadata:
  name: demo (1)
secret: "..." (2)
redirectURIs:
  - "http://www.example.com/" (3)
grantMethod: prompt (4)
')
```

(1) The **name** of the OAuth client is used as the **client_id** parameter when making requests to ***<namespace_route>*/oauth/authorize** and ***<namespace_route>*/oauth/token**.

2 The **secret** is used as the **client_secret** parameter when making requests to ***<namespace_route>*/oauth/token**.

3 The **redirect_uri** parameter specified in requests to ***<namespace_route>*/oauth/authorize** and ***<namespace_route>*/oauth/token** must be equal to or prefixed by one of the URIs listed in the **redirectURIs** parameter value.

4 The **grantMethod** is used to determine what action to take when this client requests tokens and has not yet been granted access by the user. Specify **auto** to automatically approve the grant and retry the request, or **prompt** to prompt the user to approve or deny the grant.

2.6. OAUTH SERVER METADATA

Applications running in OpenShift Container Platform might have to discover information about the built-in OAuth server. For example, they might have to discover what the address of the **<namespace_route>** is without manual configuration. To aid in this, OpenShift Container Platform implements the IETF OAuth 2.0 Authorization Server Metadata draft specification.

Thus, any application running inside the cluster can issue a **GET** request to ***https://openshift.default.svc/.well-known/oauth-authorization-server*** to fetch the following information:

```
{
  "issuer": "https://<namespace_route>", 1
  "authorization_endpoint": "https://<namespace_route>/oauth/authorize", 2
  "token_endpoint": "https://<namespace_route>/oauth/token", 3
  "scopes_supported": [ 4
    "user:full",
    "user:info",
    "user:check-access",
    "user:list-scoped-projects",
    "user:list-projects"
  ],
  "response_types_supported": [ 5
    "code",
    "token"
  ],
  "grant_types_supported": [ 6
    "authorization_code",
    "implicit"
  ],
  "code_challenge_methods_supported": [ 7
    "plain",
    "S256"
  ]
}
```

1 The authorization server's issuer identifier, which is a URL that uses the **https** scheme and has no query or fragment components. This is the location where **.well-known** RFC 5785 resources containing information about the authorization server are published.

2 URL of the authorization server's authorization endpoint. See RFC 6749.

3. URL of the authorization server's token endpoint. See RFC 6749.

4. JSON array containing a list of the OAuth 2.0 RFC 6749 scope values that this authorization server supports. Note that not all supported scope values are advertised.

5. JSON array containing a list of the OAuth 2.0 **response_type** values that this authorization server supports. The array values used are the same as those used with the **response_types** parameter defined by "OAuth 2.0 Dynamic Client Registration Protocol" in RFC 7591.

6. JSON array containing a list of the OAuth 2.0 grant type values that this authorization server supports. The array values used are the same as those used with the **grant_types** parameter defined by **OAuth 2.0 Dynamic Client Registration Protocol** in RFC 7591.

7. JSON array containing a list of PKCE RFC 7636 code challenge methods supported by this authorization server. Code challenge method values are used in the **code_challenge_method** parameter defined in Section 4.3 of RFC 7636 . The valid code challenge method values are those registered in the IANA **PKCE Code Challenge Methods** registry. See IANA OAuth Parameters.

2.7. TROUBLESHOOTING OAUTH API EVENTS

In some cases the API server returns an **unexpected condition** error message that is difficult to debug without direct access to the API master log. The underlying reason for the error is purposely obscured in order to avoid providing an unauthenticated user with information about the server's state.

A subset of these errors is related to service account OAuth configuration issues. These issues are captured in events that can be viewed by non-administrator users. When encountering an **unexpected condition** server error during OAuth, run **oc get events** to view these events under **ServiceAccount**.

The following example warns of a service account that is missing a proper OAuth redirect URI:

```
$ oc get events | grep ServiceAccount
```

Example output

```
1m        1m        1        proxy                  ServiceAccount                  Warning
NoSAOAuthRedirectURIs   service-account-oauth-client-getter
system:serviceaccount:myproject:proxy has no redirectURIs; set serviceaccounts.openshift.io/oauth-
redirecturi.<some-value>=<redirect> or create a dynamic URI using
serviceaccounts.openshift.io/oauth-redirectreference.<some-value>=<reference>
```

Running **oc describe sa/<service_account_name>** reports any OAuth events associated with the given service account name.

```
$ oc describe sa/proxy | grep -A5 Events
```

Example output

```
Events:
  FirstSeen     LastSeen        Count   From                            SubObjectPath   Type          Reason
Message
  ---------     --------        -----   ----                            -------------   --------      ------              -------
  3m            3m              1       service-account-oauth-client-getter                 Warning
```

```
NoSAOAuthRedirectURIs   system:serviceaccount:myproject:proxy has no redirectURIs; set
serviceaccounts.openshift.io/oauth-redirecturi.<some-value>=<redirect> or create a dynamic URI
using serviceaccounts.openshift.io/oauth-redirectreference.<some-value>=<reference>
```

The following is a list of the possible event errors:

No redirect URI annotations or an invalid URI is specified

```
Reason                  Message
NoSAOAuthRedirectURIs   system:serviceaccount:myproject:proxy has no redirectURIs; set
serviceaccounts.openshift.io/oauth-redirecturi.<some-value>=<redirect> or create a dynamic URI
using serviceaccounts.openshift.io/oauth-redirectreference.<some-value>=<reference>
```

Invalid route specified

```
Reason                  Message
NoSAOAuthRedirectURIs   [routes.route.openshift.io "<name>" not found,
system:serviceaccount:myproject:proxy has no redirectURIs; set serviceaccounts.openshift.io/oauth-
redirecturi.<some-value>=<redirect> or create a dynamic URI using
serviceaccounts.openshift.io/oauth-redirectreference.<some-value>=<reference>]
```

Invalid reference type specified

```
Reason                  Message
NoSAOAuthRedirectURIs   [no kind "<name>" is registered for version "v1",
system:serviceaccount:myproject:proxy has no redirectURIs; set serviceaccounts.openshift.io/oauth-
redirecturi.<some-value>=<redirect> or create a dynamic URI using
serviceaccounts.openshift.io/oauth-redirectreference.<some-value>=<reference>]
```

Missing SA tokens

```
Reason                  Message
NoSAOAuthTokens         system:serviceaccount:myproject:proxy has no tokens
```

CHAPTER 3. UNDERSTANDING IDENTITY PROVIDER CONFIGURATION

The OpenShift Container Platform master includes a built-in OAuth server. Developers and administrators obtain OAuth access tokens to authenticate themselves to the API.

As an administrator, you can configure OAuth to specify an identity provider after you install your cluster.

3.1. ABOUT IDENTITY PROVIDERS IN OPENSHIFT CONTAINER PLATFORM

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

3.2. SUPPORTED IDENTITY PROVIDERS

You can configure the following types of identity providers:

Identity provider	Description
HTPasswd	Configure the **htpasswd** identity provider to validate user names and passwords against a flat file generated using **htpasswd**.
Keystone	Configure the **keystone** identity provider to integrate your OpenShift Container Platform cluster with Keystone to enable shared authentication with an OpenStack Keystone v3 server configured to store users in an internal database.
LDAP	Configure the **ldap** identity provider to validate user names and passwords against an LDAPv3 server, using simple bind authentication.
Basic authentication	Configure a **basic-authentication** identity provider for users to log in to OpenShift Container Platform with credentials validated against a remote identity provider. Basic authentication is a generic backend integration mechanism.
Request header	Configure a **request-header** identity provider to identify users from request header values, such as **X-Remote-User**. It is typically used in combination with an authenticating proxy, which sets the request header value.
GitHub or GitHub Enterprise	Configure a **github** identity provider to validate user names and passwords against GitHub or GitHub Enterprise's OAuth authentication server.
GitLab	Configure a **gitlab** identity provider to use GitLab.com or any other GitLab instance as an identity provider.

Identity provider	Description
Google	Configure a **google** identity provider using Google's OpenID Connect integration.
OpenID Connect	Configure an **oidc** identity provider to integrate with an OpenID Connect identity provider using an Authorization Code Flow.

Once an identity provider has been defined, you can use RBAC to define and apply permissions .

3.3. REMOVING THE KUBEADMIN USER

After you define an identity provider and create a new **cluster-admin** user, you can remove the **kubeadmin** to improve cluster security.

WARNING

If you follow this procedure before another user is a **cluster-admin**, then OpenShift Container Platform must be reinstalled. It is not possible to undo this command.

Prerequisites

- You must have configured at least one identity provider.
- You must have added the **cluster-admin** role to a user.
- You must be logged in as an administrator.

Procedure

- Remove the **kubeadmin** secrets:

```
$ oc delete secrets kubeadmin -n kube-system
```

3.4. IDENTITY PROVIDER PARAMETERS

The following parameters are common to all identity providers:

Parameter	Description
name	The provider name is prefixed to provider user names to form an identity name.

Parameter	Description
mappingMethod	Defines how new identities are mapped to users when they log in. Enter one of the following values: **claim** The default value. Provisions a user with the identity's preferred user name. Fails if a user with that user name is already mapped to another identity. **lookup** Looks up an existing identity, user identity mapping, and user, but does not automatically provision users or identities. This allows cluster administrators to set up identities and users manually, or using an external process. Using this method requires you to manually provision users. **generate** Provisions a user with the identity's preferred user name. If a user with the preferred user name is already mapped to an existing identity, a unique user name is generated. For example, **myuser2**. This method should not be used in combination with external processes that require exact matches between OpenShift Container Platform user names and identity provider user names, such as LDAP group sync. **add** Provisions a user with the identity's preferred user name. If a user with that user name already exists, the identity is mapped to the existing user, adding to any existing identity mappings for the user. Required when multiple identity providers are configured that identify the same set of users and map to the same user names.

NOTE

When adding or changing identity providers, you can map identities from the new provider to existing users by setting the **mappingMethod** parameter to **add**.

3.5. SAMPLE IDENTITY PROVIDER CR

The following custom resource (CR) shows the parameters and default values that you use to configure an identity provider. This example uses the HTPasswd identity provider.

Sample identity provider CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: my_identity_provider 1
    mappingMethod: claim 2
    type: HTPasswd
    htpasswd:
      fileData:
        name: htpass-secret 3
```

1 This provider name is prefixed to provider user names to form an identity name.

2 Controls how mappings are established between this provider's identities and **User** objects.

3 An existing secret containing a file generated using **htpasswd**.

CHAPTER 4. CONFIGURING IDENTITY PROVIDERS

4.1. CONFIGURING AN HTPASSWD IDENTITY PROVIDER

4.1.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a Custom Resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

To define an HTPasswd identity provider you must perform the following steps:

1. Create an **htpasswd** file to store the user and password information. Instructions are provided for Linux and Windows.
2. Create an OpenShift Container Platform secret to represent the **htpasswd** file.
3. Define the HTPasswd identity provider resource .
4. Apply the resource to the default OAuth configuration .

4.1.2. Creating an HTPasswd file using Linux

To use the HTPasswd identity provider, you must generate a flat file that contains the user names and passwords for your cluster by using **htpasswd**.

Prerequisites

- Have access to the **htpasswd** utility. On Red Hat Enterprise Linux this is available by installing the **httpd-tools** package.

Procedure

1. Create or update your flat file with a user name and hashed password:

```
$ htpasswd -c -B -b </path/to/users.htpasswd> <user_name> <password>
```

The command generates a hashed version of the password.

For example:

```
$ htpasswd -c -B -b users.htpasswd user1 MyPassword!
```

Example output

```
Adding password for user user1
```

2. Continue to add or update credentials to the file:

```
$ htpasswd -B -b </path/to/users.htpasswd> <user_name> <password>
```

4.1.3. Creating an HTPasswd file using Windows

To use the HTPasswd identity provider, you must generate a flat file that contains the user names and passwords for your cluster by using **htpasswd**.

Prerequisites

- Have access to **htpasswd.exe**. This file is included in the **\bin** directory of many Apache httpd distributions.

Procedure

1. Create or update your flat file with a user name and hashed password:

```
> htpasswd.exe -c -B -b <\path\to\users.htpasswd> <user_name> <password>
```

The command generates a hashed version of the password.

For example:

```
> htpasswd.exe -c -B -b users.htpasswd user1 MyPassword!
```

Example output

```
Adding password for user user1
```

2. Continue to add or update credentials to the file:

```
> htpasswd.exe -b <\path\to\users.htpasswd> <user_name> <password>
```

4.1.4. Creating the HTPasswd Secret

To use the HTPasswd identity provider, you must define a secret that contains the HTPasswd user file.

Prerequisites

- Create an HTPasswd file.

Procedure

- Create an OpenShift Container Platform **Secret** object that contains the HTPasswd users file.

```
$ oc create secret generic htpass-secret --from-file=htpasswd=</path/to/users.htpasswd> -n
openshift-config
```

NOTE

The secret key containing the users file for the **--from-file** argument must be named **htpasswd**, as shown in the above command.

4.1.5. Sample HTPasswd CR

The following custom resource (CR) shows the parameters and acceptable values for an HTPasswd identity provider.

HTPasswd CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: my_htpasswd_provider 1
    mappingMethod: claim 2
    type: HTPasswd
    htpasswd:
      fileData:
        name: htpass-secret 3
```

1. This provider name is prefixed to provider user names to form an identity name.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. An existing secret containing a file generated using **htpasswd**.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.1.6. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```

NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

4.1.7. Updating users for an HTPasswd identity provider

You can add or remove users from an existing HTPasswd identity provider.

Prerequisites

- You have created a **Secret** object that contains the HTPasswd user file. This procedure assumes that it is named **htpass-secret**.
- You have configured an HTPasswd identity provider. This procedure assumes that it is named **my_htpasswd_provider**.
- You have access to the **htpasswd** utility. On Red Hat Enterprise Linux this is available by installing the **httpd-tools** package.
- You have cluster administrator privileges.

Procedure

1. Retrieve the HTPasswd file from the **htpass-secret Secret** object and save the file to your file system:

```
$ oc get secret htpass-secret -ojsonpath={.data.htpasswd} -n openshift-config | base64 --
decode > users.htpasswd
```

2. Add or remove users from the **users.htpasswd** file.
   - To add a new user:

```
$ htpasswd -bB users.htpasswd <username> <password>
```

     Example output

```
Adding password for user <username>
```

   - To remove an existing user:

```
$ htpasswd -D users.htpasswd <username>
```

Example output

```
Deleting password for user <username>
```

3. Replace the **htpass-secret Secret** object with the updated users in the **users.htpasswd** file:

```
$ oc create secret generic htpass-secret --from-file=htpasswd=users.htpasswd --dry-
run=client -o yaml -n openshift-config | oc replace -f -
```

4. If you removed one or more users, you must additionally remove existing resources for each user.

   a. Delete the **User** object:

```
$ oc delete user <username>
```

   Example output

```
user.user.openshift.io "<username>" deleted
```

   Be sure to remove the user, otherwise the user can continue using their token as long as it has not expired.

   b. Delete the **Identity** object for the user:

```
$ oc delete identity my_htpasswd_provider:<username>
```

   Example output

```
identity.user.openshift.io "my_htpasswd_provider:<username>" deleted
```

4.1.8. Configuring identity providers using the web console

Configure your identity provider (IDP) through the web console instead of the CLI.

Prerequisites

- You must be logged in to the web console as a cluster administrator.

Procedure

1. Navigate to **Administration → Cluster Settings**.
2. Under the **Global Configuration** tab, click **OAuth**.
3. Under the **Identity Providers** section, select your identity provider from the **Add** drop-down menu.

NOTE

You can specify multiple IDPs through the web console without overwriting existing IDPs.

4.2. CONFIGURING A KEYSTONE IDENTITY PROVIDER

Configure the **keystone** identity provider to integrate your OpenShift Container Platform cluster with Keystone to enable shared authentication with an OpenStack Keystone v3 server configured to store users in an internal database. This configuration allows users to log in to OpenShift Container Platform with their Keystone credentials.

Keystone is an OpenStack project that provides identity, token, catalog, and policy services.

You can configure the integration with Keystone so that the new OpenShift Container Platform users are based on either the Keystone user names or unique Keystone IDs. With both methods, users log in by entering their Keystone user name and password. Basing the OpenShift Container Platform users off of the Keystone ID is more secure. If you delete a Keystone user and create a new Keystone user with that user name, the new user might have access to the old user's resources.

4.2.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.2.2. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.2.3. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.2.4. Sample Keystone CR

The following custom resource (CR) shows the parameters and acceptable values for a Keystone identity provider.

Keystone CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: keystoneidp (1)
    mappingMethod: claim (2)
    type: Keystone
    keystone:
      domainName: default (3)
      url: https://keystone.example.com:5000 (4)
      ca: (5)
        name: ca-config-map
      tlsClientCert: (6)
        name: client-cert-secret
      tlsClientKey: (7)
        name: client-key-secret
```

1. This provider name is prefixed to provider user names to form an identity name.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. Keystone domain name. In Keystone, usernames are domain-specific. Only a single domain is supported.
4. The URL to use to connect to the Keystone server (required). This must use https.
5. Optional: Reference to an OpenShift Container Platform **ConfigMap** object containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL.
6. Optional: Reference to an OpenShift Container Platform **Secret** object containing the client certificate to present when making requests to the configured URL.
7. Reference to an OpenShift Container Platform **Secret** object containing the key for the client certificate. Required if **tlsClientCert** is specified.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.2.5. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```

NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

4.3. CONFIGURING AN LDAP IDENTITY PROVIDER

Configure the **ldap** identity provider to validate user names and passwords against an LDAPv3 server, using simple bind authentication.

4.3.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.3.2. About LDAP authentication

During authentication, the LDAP directory is searched for an entry that matches the provided user name. If a single unique match is found, a simple bind is attempted using the distinguished name (DN) of the entry plus the provided password.

These are the steps taken:

1. Generate a search filter by combining the attribute and filter in the configured **url** with the user-provided user name.
2. Search the directory using the generated filter. If the search does not return exactly one entry, deny access.
3. Attempt to bind to the LDAP server using the DN of the entry retrieved from the search, and the user-provided password.
4. If the bind is unsuccessful, deny access.
5. If the bind is successful, build an identity using the configured attributes as the identity, email address, display name, and preferred user name.

The configured **url** is an RFC 2255 URL, which specifies the LDAP host and search parameters to use. The syntax of the URL is:

```
ldap://host:port/basedn?attribute?scope?filter
```

For this URL:

URL component	Description
ldap	For regular LDAP, use the string **ldap**. For secure LDAP (LDAPS), use **ldaps** instead.
host:port	The name and port of the LDAP server. Defaults to **localhost:389** for ldap and **localhost:636** for LDAPS.
basedn	The DN of the branch of the directory where all searches should start from. At the very least, this must be the top of your directory tree, but it could also specify a subtree in the directory.
attribute	The attribute to search for. Although RFC 2255 allows a comma-separated list of attributes, only the first attribute will be used, no matter how many are provided. If no attributes are provided, the default is to use **uid**. It is recommended to choose an attribute that will be unique across all entries in the subtree you will be using.
scope	The scope of the search. Can be either **one** or **sub**. If the scope is not provided, the default is to use a scope of **sub**.
filter	A valid LDAP search filter. If not provided, defaults to **(objectClass=*)**

When doing searches, the attribute, filter, and provided user name are combined to create a search filter that looks like:

```
(&(<filter>)(<attribute>=<username>))
```

For example, consider a URL of:

```
ldap://ldap.example.com/o=Acme?cn?sub?(enabled=true)
```

When a client attempts to connect using a user name of **bob**, the resulting search filter will be **(&(enabled=true)(cn=bob))**.

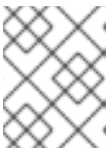
If the LDAP directory requires authentication to search, specify a **bindDN** and **bindPassword** to use to perform the entry search.

4.3.3. Creating the LDAP secret

To use the identity provider, you must define an OpenShift Container Platform **Secret** object that contains the **bindPassword** field.

- Define an OpenShift Container Platform **Secret** object that contains the **bindPassword** field.

```
$ oc create secret generic ldap-secret --from-literal=bindPassword=<secret> -n openshift-config
```



NOTE

The secret key containing the bindPassword for the **--from-literal** argument must be called **bindPassword**, as shown in the above command.

4.3.4. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.3.5. Sample LDAP CR

The following custom resource (CR) shows the parameters and acceptable values for an LDAP identity provider.

LDAP CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: ldapidp 1
```

```
  mappingMethod: claim (2)
  type: LDAP
  ldap:
    attributes:
      id: (3)
      - dn
      email: (4)
      - mail
      name: (5)
      - cn
      preferredUsername: (6)
      - uid
    bindDN: "" (7)
    bindPassword: (8)
      name: ldap-secret
    ca: (9)
      name: ca-config-map
    insecure: false (10)
    url: "ldap://ldap.example.com/ou=users,dc=acme,dc=com?uid" (11)
```

1. This provider name is prefixed to the returned user ID to form an identity name.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. List of attributes to use as the identity. First non-empty attribute is used. At least one attribute is required. If none of the listed attribute have a value, authentication fails. Defined attributes are retrieved as raw, allowing for binary values to be used.
4. List of attributes to use as the email address. First non-empty attribute is used.
5. List of attributes to use as the display name. First non-empty attribute is used.
6. List of attributes to use as the preferred user name when provisioning a user for this identity. First non-empty attribute is used.
7. Optional DN to use to bind during the search phase. Must be set if **bindPassword** is defined.
8. Optional reference to an OpenShift Container Platform **Secret** object containing the bind password. Must be set if **bindDN** is defined.
9. Optional: Reference to an OpenShift Container Platform **ConfigMap** object containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL. Only used when **insecure** is **false**.
10. When **true**, no TLS connection is made to the server. When **false**, **ldaps://** URLs connect using TLS, and **ldap://** URLs are upgraded to TLS. This must be set to **false** when **ldaps://** URLs are in use, as these URLs always attempt to connect using TLS.
11. An RFC 2255 URL which specifies the LDAP host and search parameters to use.

NOTE

To whitelist users for an LDAP integration, use the **lookup** mapping method. Before a login from LDAP would be allowed, a cluster administrator must create an **Identity** object and a **User** object for each LDAP user.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.3.6. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

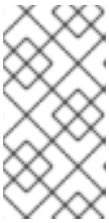
Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

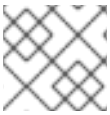
```
$ oc whoami
```

4.4. CONFIGURING A BASIC AUTHENTICATION IDENTITY PROVIDER

Configure a **basic-authentication** identity provider for users to log in to OpenShift Container Platform with credentials validated against a remote identity provider. Basic authentication is a generic back-end integration mechanism.

4.4.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.



NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.4.2. About basic authentication

Basic authentication is a generic back-end integration mechanism that allows users to log in to OpenShift Container Platform with credentials validated against a remote identity provider.

Because basic authentication is generic, you can use this identity provider for advanced authentication configurations.

IMPORTANT

Basic authentication must use an HTTPS connection to the remote server to prevent potential snooping of the user ID and password and man-in-the-middle attacks.

With basic authentication configured, users send their user name and password to OpenShift Container Platform, which then validates those credentials against a remote server by making a server-to-server request, passing the credentials as a basic authentication header. This requires users to send their credentials to OpenShift Container Platform during login.

NOTE

This only works for user name/password login mechanisms, and OpenShift Container Platform must be able to make network requests to the remote authentication server.

User names and passwords are validated against a remote URL that is protected by basic authentication and returns JSON.

A **401** response indicates failed authentication.

A non-**200** status, or the presence of a non-empty "error" key, indicates an error:

```
{"error":"Error message"}
```

A **200** status with a **sub** (subject) key indicates success:

```
{"sub":"userid"} 1
```

1 The subject must be unique to the authenticated user and must not be able to be modified.

A successful response can optionally provide additional data, such as:

- A display name using the **name** key. For example:

  ```
  {"sub":"userid", "name": "User Name", ...}
  ```

- An email address using the **email** key. For example:

```
{"sub":"userid", "email":"user@example.com", ...}
```

- A preferred user name using the **preferred_username** key. This is useful when the unique, unchangeable subject is a database key or UID, and a more human-readable name exists. This is used as a hint when provisioning the OpenShift Container Platform user for the authenticated identity. For example:

```
{"sub":"014fbff9a07c", "preferred_username":"bob", ...}
```

4.4.3. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.4.4. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.4.5. Sample basic authentication CR

The following custom resource (CR) shows the parameters and acceptable values for a basic authentication identity provider.

Basic authentication CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
```

```
- name: basicidp (1)
  mappingMethod: claim (2)
  type: BasicAuth
  basicAuth:
    url: https://www.example.com/remote-idp (3)
    ca: (4)
      name: ca-config-map
    tlsClientCert: (5)
      name: client-cert-secret
    tlsClientKey: (6)
      name: client-key-secret
```

1. This provider name is prefixed to the returned user ID to form an identity name.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. URL accepting credentials in Basic authentication headers.
4. Optional: Reference to an OpenShift Container Platform **ConfigMap** object containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL.
5. Optional: Reference to an OpenShift Container Platform **Secret** object containing the client certificate to present when making requests to the configured URL.
6. Reference to an OpenShift Container Platform **Secret** object containing the key for the client certificate. Required if **tlsClientCert** is specified.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.4.6. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

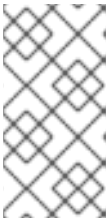
Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

4.4.7. Example Apache HTTPD configuration for basic identity providers

The basic identify provider (IDP) configuration in OpenShift Container Platform 4 requires that the IDP server respond with JSON for success and failures. You can use CGI scripting in Apache HTTPD to accomplish this. This section provides examples.

Example /etc/httpd/conf.d/login.conf

```
<VirtualHost *:443>
  # CGI Scripts in here
  DocumentRoot /var/www/cgi-bin

  # SSL Directives
  SSLEngine on
  SSLCipherSuite PROFILE=SYSTEM
  SSLProxyCipherSuite PROFILE=SYSTEM
  SSLCertificateFile /etc/pki/tls/certs/localhost.crt
  SSLCertificateKeyFile /etc/pki/tls/private/localhost.key

  # Configure HTTPD to execute scripts
  ScriptAlias /basic /var/www/cgi-bin

  # Handles a failed login attempt
  ErrorDocument 401 /basic/fail.cgi

  # Handles authentication
  <Location /basic/login.cgi>
    AuthType Basic
    AuthName "Please Log In"
    AuthBasicProvider file
    AuthUserFile /etc/httpd/conf/passwords
    Require valid-user
  </Location>
</VirtualHost>
```

Example /var/www/cgi-bin/login.cgi

```
#!/bin/bash
echo "Content-Type: application/json"
echo ""
echo '{"sub":"userid", "name":"'$REMOTE_USER'"}'
exit 0
```

Example /var/www/cgi-bin/fail.cgi

```
#!/bin/bash
echo "Content-Type: application/json"
echo ""
echo '{"error": "Login failure"}'
exit 0
```

4.4.7.1. File requirements

These are the requirements for the files you create on an Apache HTTPD web server:

- **login.cgi** and **fail.cgi** must be executable (**chmod +x**).
- **login.cgi** and **fail.cgi** must have proper SELinux contexts if SELinux is enabled: **restorecon -RFv /var/www/cgi-bin**, or ensure that the context is **httpd_sys_script_exec_t** using **ls -laZ**.
- **login.cgi** is only executed if your user successfully logs in per **Require and Auth** directives.
- **fail.cgi** is executed if the user fails to log in, resulting in an **HTTP 401** response.

4.4.8. Basic authentication troubleshooting

The most common issue relates to network connectivity to the backend server. For simple debugging, run **curl** commands on the master. To test for a successful login, replace the **<user>** and **<password>** in the following example command with valid credentials. To test an invalid login, replace them with false credentials.

```
$ curl --cacert /path/to/ca.crt --cert /path/to/client.crt --key /path/to/client.key -u <user>:<password> -v
https://www.example.com/remote-idp
```

Successful responses

A **200** status with a **sub** (subject) key indicates success:

```
{"sub":"userid"}
```

The subject must be unique to the authenticated user, and must not be able to be modified.

A successful response can optionally provide additional data, such as:

- A display name using the **name** key:

  ```
  {"sub":"userid", "name": "User Name", ...}
  ```

- An email address using the **email** key:

```
{"sub":"userid", "email":"user@example.com", ...}
```

- A preferred user name using the **preferred_username** key:

```
{"sub":"014fbff9a07c", "preferred_username":"bob", ...}
```

The **preferred_username** key is useful when the unique, unchangeable subject is a database key or UID, and a more human-readable name exists. This is used as a hint when provisioning the OpenShift Container Platform user for the authenticated identity.

Failed responses

- A **401** response indicates failed authentication.
- A non-**200** status or the presence of a non-empty "error" key indicates an error: **{"error":"Error message"}**

4.5. CONFIGURING A REQUEST HEADER IDENTITY PROVIDER

Configure a **request-header** identity provider to identify users from request header values, such as **X-Remote-User**. It is typically used in combination with an authenticating proxy, which sets the request header value.

4.5.1. About identity providers in OpenShift Container Platform

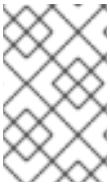
By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.5.2. About request header authentication

A request header identity provider identifies users from request header values, such as **X-Remote-User**. It is typically used in combination with an authenticating proxy, which sets the request header value. The request header identity provider cannot be combined with other identity providers that use direct password logins, such as HTPasswd, Keystone, LDAP or Basic authentication.



NOTE

You can also use the request header identity provider for advanced configurations such as the community-supported SAML authentication. Note that this solution is not supported by Red Hat.

For users to authenticate using this identity provider, they must access **https://*<namespace_route>*/oauth/authorize** (and subpaths) via an authenticating proxy. To accomplish this, configure the OAuth server to redirect unauthenticated requests for OAuth tokens to the proxy endpoint that proxies to **https://*<namespace_route>*/oauth/authorize**.

To redirect unauthenticated requests from clients expecting browser-based login flows:

- Set the **provider.loginURL** parameter to the authenticating proxy URL that will authenticate interactive clients and then proxy the request to **https://*<namespace_route>*/oauth/authorize**.

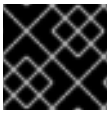
To redirect unauthenticated requests from clients expecting **WWW-Authenticate** challenges:

- Set the **provider.challengeURL** parameter to the authenticating proxy URL that will authenticate clients expecting **WWW-Authenticate** challenges and then proxy the request to **https://*<namespace_route>*/oauth/authorize**.

The **provider.challengeURL** and **provider.loginURL** parameters can include the following tokens in the query portion of the URL:

- **${url}** is replaced with the current URL, escaped to be safe in a query parameter.
  For example: **https://www.example.com/sso-login?then=${url}**

- **${query}** is replaced with the current query string, unescaped.
  For example: **https://www.example.com/auth-proxy/oauth/authorize?${query}**



IMPORTANT

As of OpenShift Container Platform 4.1, your proxy must support mutual TLS.

4.5.2.1. SSPI connection support on Microsoft Windows

IMPORTANT

Using SSPI connection support on Microsoft Windows is a Technology Preview feature. Technology Preview features are not supported with Red Hat production service level agreements (SLAs), might not be functionally complete, and Red Hat does not recommend to use them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information on Red Hat Technology Preview features support scope, see https://access.redhat.com/support/offerings/techpreview/.

The OpenShift CLI (**oc**) supports the Security Support Provider Interface (SSPI) to allow for SSO flows on Microsft Windows. If you use the request header identity provider with a GSSAPI-enabled proxy to connect an Active Directory server to OpenShift Container Platform, users can automatically authenticate to OpenShift Container Platform by using the **oc** command line interface from a domain-joined Microsoft Windows computer.

4.5.3. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.5.4. Sample request header CR

The following custom resource (CR) shows the parameters and acceptable values for a request header identity provider.

Request header CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: requestheaderidp 1
    mappingMethod: claim 2
    type: RequestHeader
    requestHeader:
      challengeURL: "https://www.example.com/challenging-proxy/oauth/authorize?${query}" 3
      loginURL: "https://www.example.com/login-proxy/oauth/authorize?${query}" 4
      ca: 5
        name: ca-config-map
      clientCommonNames: 6
      - my-auth-proxy
      headers: 7
      - X-Remote-User
      - SSO-User
      emailHeaders: 8
      - X-Remote-User-Email
      nameHeaders: 9
      - X-Remote-User-Display-Name
      preferredUsernameHeaders: 10
      - X-Remote-User-Login
```

1. This provider name is prefixed to the user name in the request header to form an identity name.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. Optional: URL to redirect unauthenticated **/oauth/authorize** requests to, that will authenticate browser-based clients and then proxy their request to **https://*<namespace_route>*/oauth/authorize**. The URL that proxies to **https://*<namespace_route>*/oauth/authorize** must end with **/authorize** (with no trailing slash), and also proxy subpaths, in order for OAuth approval flows to work properly. **${url}** is replaced with the current URL, escaped to be safe in a query parameter. **${query}** is replaced with the current query string. If this attribute is not defined, then **loginURL** must be used.
4. Optional: URL to redirect unauthenticated **/oauth/authorize** requests to, that will authenticate clients which expect **WWW-Authenticate** challenges, and then proxy them to **https://*<namespace_route>*/oauth/authorize**. **${url}** is replaced with the current URL, escaped to be safe in a query parameter. **${query}** is replaced with the current query string. If this attribute is not defined, then **challengeURL** must be used.

5 Reference to an OpenShift Container Platform **ConfigMap** object containing a PEM-encoded certificate bundle. Used as a trust anchor to validate the TLS certificates presented by the remote

IMPORTANT

As of OpenShift Container Platform 4.1, the **ca** field is required for this identity provider. This means that your proxy must support mutual TLS.

6 Optional: list of common names (**cn**). If set, a valid client certificate with a Common Name (**cn**) in the specified list must be presented before the request headers are checked for user names. If empty, any Common Name is allowed. Can only be used in combination with **ca**.

7 Header names to check, in order, for the user identity. The first header containing a value is used as the identity. Required, case-insensitive.

8 Header names to check, in order, for an email address. The first header containing a value is used as the email address. Optional, case-insensitive.

9 Header names to check, in order, for a display name. The first header containing a value is used as the display name. Optional, case-insensitive.

10 Header names to check, in order, for a preferred user name, if different than the immutable identity determined from the headers specified in **headers**. The first header containing a value is used as the preferred user name when provisioning. Optional, case-insensitive.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.5.5. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```

NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

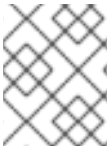
```
$ oc whoami
```

4.5.6. Example Apache authentication configuration using request header

This example configures an Apache authentication proxy for the OpenShift Container Platform using the request header identity provider.

Custom proxy configuration
Using the **mod_auth_gssapi** module is a popular way to configure the Apache authentication proxy using the request header identity provider; however, it is not required. Other proxies can easily be used if the following requirements are met:

- Block the **X-Remote-User** header from client requests to prevent spoofing.
- Enforce client certificate authentication in the **RequestHeaderIdentityProvider** configuration.
- Require the **X-Csrf-Token** header be set for all authentication requests using the challenge flow.
- Make sure only the **/oauth/authorize** endpoint and its subpaths are proxied; redirects must be rewritten to allow the backend server to send the client to the correct location.
- The URL that proxies to **https://<namespace_route>/oauth/authorize** must end with **/authorize** with no trailing slash. For example, **https://proxy.example.com/login-proxy/authorize?…** must proxy to **https://<namespace_route>/oauth/authorize?…**.
- Subpaths of the URL that proxies to **https://<namespace_route>/oauth/authorize** must proxy to subpaths of **https://<namespace_route>/oauth/authorize**. For example, **https://proxy.example.com/login-proxy/authorize/approve?…** must proxy to **https://<namespace_route>/oauth/authorize/approve?…**.



NOTE

The **https://<namespace_route>** address is the route to the OAuth server and can be obtained by running **oc get route -n openshift-authentication**.

Configuring Apache authentication using request header
This example uses the **mod_auth_gssapi** module to configure an Apache authentication proxy using the request header identity provider.

Prerequisites

- Obtain the **mod_auth_gssapi** module from the Optional channel. You must have the following packages installed on your local machine:
  - **httpd**
  - **mod_ssl**
  - **mod_session**
  - **apr-util-openssl**
  - **mod_auth_gssapi**
- Generate a CA for validating requests that submit the trusted header. Define an OpenShift Container Platform **ConfigMap** object containing the CA. This is done by running:

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

  The CA must be stored in the **ca.crt** key of the **ConfigMap** object.
- Generate a client certificate for the proxy. You can generate this certificate by using any x509 certificate tooling. The client certificate must be signed by the CA you generated for validating requests that submit the trusted header.
- Create the custom resource (CR) for your identity providers.

Procedure

This proxy uses a client certificate to connect to the OAuth server, which is configured to trust the **X-Remote-User** header.

1. Create the certificate for the Apache configuration. The certificate that you specify as the **SSLProxyMachineCertificateFile** parameter value is the proxy's client certificate that is used to authenticate the proxy to the server. It must use **TLS Web Client Authentication** as the extended key type.
2. Create the Apache configuration. Use the following template to provide your required settings and values:

IMPORTANT

Carefully review the template and customize its contents to fit your environment.

```
LoadModule request_module modules/mod_request.so
LoadModule auth_gssapi_module modules/mod_auth_gssapi.so
# Some Apache configurations might require these modules.
# LoadModule auth_form_module modules/mod_auth_form.so
# LoadModule session_module modules/mod_session.so

# Nothing needs to be served over HTTP.  This virtual host simply redirects to
# HTTPS.
<VirtualHost *:80>
  DocumentRoot /var/www/html
  RewriteEngine              On
```

```
  RewriteRule     ^(.*)$     https://%{HTTP_HOST}$1 [R,L]
</VirtualHost>

<VirtualHost *:443>
  # This needs to match the certificates you generated.  See the CN and X509v3
  # Subject Alternative Name in the output of:
  # openssl x509 -text -in /etc/pki/tls/certs/localhost.crt
  ServerName www.example.com

  DocumentRoot /var/www/html
  SSLEngine on
  SSLCertificateFile /etc/pki/tls/certs/localhost.crt
  SSLCertificateKeyFile /etc/pki/tls/private/localhost.key
  SSLCACertificateFile /etc/pki/CA/certs/ca.crt

  SSLProxyEngine on
  SSLProxyCACertificateFile /etc/pki/CA/certs/ca.crt
  # It is critical to enforce client certificates. Otherwise, requests can
  # spoof the X-Remote-User header by accessing the /oauth/authorize endpoint
  # directly.
  SSLProxyMachineCertificateFile /etc/pki/tls/certs/authproxy.pem

  # To use the challenging-proxy, an X-Csrf-Token must be present.
  RewriteCond %{REQUEST_URI} ^/challenging-proxy
  RewriteCond %{HTTP:X-Csrf-Token} ^$ [NC]
  RewriteRule ^.* - [F,L]

  <Location /challenging-proxy/oauth/authorize>
     # Insert your backend server name/ip here.
     ProxyPass https://<namespace_route>/oauth/authorize
     AuthName "SSO Login"
     # For Kerberos
     AuthType GSSAPI
     Require valid-user
     RequestHeader set X-Remote-User %{REMOTE_USER}s

     GssapiCredStore keytab:/etc/httpd/protected/auth-proxy.keytab
     # Enable the following if you want to allow users to fallback
     # to password based authentication when they do not have a client
     # configured to perform kerberos authentication.
     GssapiBasicAuth On

     # For ldap:
     # AuthBasicProvider ldap
     # AuthLDAPURL "ldap://ldap.example.com:389/ou=People,dc=my-domain,dc=com?uid?
sub?(objectClass=*)"
   </Location>

   <Location /login-proxy/oauth/authorize>
   # Insert your backend server name/ip here.
   ProxyPass https://<namespace_route>/oauth/authorize

     AuthName "SSO Login"
     AuthType GSSAPI
     Require valid-user
     RequestHeader set X-Remote-User %{REMOTE_USER}s env=REMOTE_USER
```

```
    GssapiCredStore keytab:/etc/httpd/protected/auth-proxy.keytab
    # Enable the following if you want to allow users to fallback
    # to password based authentication when they do not have a client
    # configured to perform kerberos authentication.
    GssapiBasicAuth On

    ErrorDocument 401 /login.html
  </Location>

</VirtualHost>

RequestHeader unset X-Remote-User
```

NOTE

The **https://<namespace_route>** address is the route to the OAuth server and can be obtained by running **oc get route -n openshift-authentication**.

3. Update the **identityProviders** stanza in the custom resource (CR):

```
identityProviders:
 - name: requestheaderidp
   type: RequestHeader
   requestHeader:
     challengeURL: "https://<namespace_route>/challenging-proxy/oauth/authorize?${query}"
     loginURL: "https://<namespace_route>/login-proxy/oauth/authorize?${query}"
     ca:
       name: ca-config-map
       clientCommonNames:
       - my-auth-proxy
       headers:
       - X-Remote-User
```

4. Verify the configuration.

   a. Confirm that you can bypass the proxy by requesting a token by supplying the correct client certificate and header:

```
# curl -L -k -H "X-Remote-User: joe" \
    --cert /etc/pki/tls/certs/authproxy.pem \
    https://<namespace_route>/oauth/token/request
```

   b. Confirm that requests that do not supply the client certificate fail by requesting a token without the certificate:

```
# curl -L -k -H "X-Remote-User: joe" \
    https://<namespace_route>/oauth/token/request
```

   c. Confirm that the **challengeURL** redirect is active:

```
# curl -k -v -H 'X-Csrf-Token: 1' \
    https://<namespace_route>/oauth/authorize?client_id=openshift-challenging-
client&response_type=token
```

Copy the **challengeURL** redirect to use in the next step.

d. Run this command to show a **401** response with a **WWW-Authenticate** basic challenge, a negotiate challenge, or both challenges:

```
# curl -k -v -H 'X-Csrf-Token: 1' \
  <challengeURL_redirect + query>
```

e. Test logging in to the OpenShift CLI (**oc**) with and without using a Kerberos ticket:

i. If you generated a Kerberos ticket by using **kinit**, destroy it:

```
# kdestroy -c cache_name 1
```

1 Make sure to provide the name of your Kerberos cache.

ii. Log in to the **oc** tool by using your Kerberos credentials:

```
# oc login
```

Enter your Kerberos user name and password at the prompt.

iii. Log out of the **oc** tool:

```
# oc logout
```

iv. Use your Kerberos credentials to get a ticket:

```
# kinit
```

Enter your Kerberos user name and password at the prompt.

v. Confirm that you can log in to the **oc** tool:

```
# oc login
```

If your configuration is correct, you are logged in without entering separate credentials.

4.6. CONFIGURING A GITHUB OR GITHUB ENTERPRISE IDENTITY PROVIDER

Configure a **github** identity provider to validate user names and passwords against GitHub or GitHub Enterprise's OAuth authentication server. OAuth facilitates a token exchange flow between OpenShift Container Platform and GitHub or GitHub Enterprise.

You can use the GitHub integration to connect to either GitHub or GitHub Enterprise. For GitHub Enterprise integrations, you must provide the **hostname** of your instance and can optionally provide a **ca** certificate bundle to use in requests to the server.

NOTE

The following steps apply to both GitHub and GitHub Enterprise unless noted.

Configuring GitHub authentication allows users to log in to OpenShift Container Platform with their GitHub credentials. To prevent anyone with any GitHub user ID from logging in to your OpenShift Container Platform cluster, you can restrict access to only those in specific GitHub organizations.

4.6.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.6.2. Registering a GitHub application

To use GitHub or GitHub Enterprise as an identity provider, you must register an application to use.

Procedure

1. Register an application on GitHub:
   - For GitHub, click Settings → Developer settings → OAuth Apps → Register a new OAuth application.
   - For GitHub Enterprise, go to your GitHub Enterprise home page and then click **Settings → Developer settings → Register a new application**.
2. Enter an application name, for example **My OpenShift Install**.
3. Enter a homepage URL, such as **https://oauth-openshift.apps.<cluster-name>.<cluster-domain>**.
4. Optional: Enter an application description.
5. Enter the authorization callback URL, where the end of the URL contains the identity provider **name**:

   ```
   https://oauth-openshift.apps.<cluster-name>.<cluster-domain>/oauth2callback/<idp-provider-name>
   ```

   For example:

   ```
   https://oauth-openshift.apps.example-openshift-cluster.com/oauth2callback/github/
   ```

6. Click **Register application**. GitHub provides a client ID and a client secret. You need these values to complete the identity provider configuration.

4.6.3. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.6.4. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

NOTE

This procedure is only required for GitHub Enterprise.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.6.5. Sample GitHub CR

The following custom resource (CR) shows the parameters and acceptable values for a GitHub identity provider.

GitHub CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: githubidp (1)
    mappingMethod: claim (2)
    type: GitHub
    github:
      ca: (3)
        name: ca-config-map
      clientID: {...} (4)
      clientSecret: (5)
        name: github-secret
      hostname: ... (6)
      organizations: (7)
      - myorganization1
      - myorganization2
```

```
    teams: 8
    - myorganization1/team-a
    - myorganization2/team-b
```

1. This provider name is prefixed to the GitHub numeric user ID to form an identity name. It is also used to build the callback URL.

2. Controls how mappings are established between this provider's identities and **User** objects.

3. Optional: Reference to an OpenShift Container Platform **ConfigMap** object containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL. Only for use in GitHub Enterprise with a non-publicly trusted root certificate.

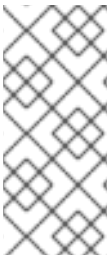
4. The client ID of a registered GitHub OAuth application. The application must be configured with a callback URL of **https://oauth-openshift.apps.<cluster-name>.<cluster-domain>/oauth2callback/<idp-provider-name>**.

5. Reference to an OpenShift Container Platform **Secret** object containing the client secret issued by GitHub.

6. For GitHub Enterprise, you must provide the host name of your instance, such as **example.com**. This value must match the GitHub Enterprise **hostname** value in in the **/setup/settings** file and cannot include a port number. If this value is not set, then either **teams** or **organizations** must be defined. For GitHub, omit this parameter.

7. The list of organizations. Either the **organizations** or **teams** field must be set unless the **hostname** field is set, or if **mappingMethod** is set to **lookup**. Cannot be used in combination with the **teams** field.

8. The list of teams. Either the **teams** or **organizations** field must be set unless the **hostname** field is set, or if **mappingMethod** is set to **lookup**. Cannot be used in combination with the **organizations** field.



NOTE

If **organizations** or **teams** is specified, only GitHub users that are members of at least one of the listed organizations will be allowed to log in. If the GitHub OAuth application configured in **clientID** is not owned by the organization, an organization owner must grant third-party access in order to use this option. This can be done during the first GitHub login by the organization's administrator, or from the GitHub organization settings.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.6.6. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

Prerequisites

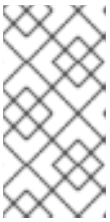
- Create an OpenShift Container Platform cluster.

- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Obtain a token from the OAuth server.
   As long as the **kubeadmin** user has been removed, the **oc login** command provides instructions on how to access a web page where you can retrieve the token.

   You can also access this page from the web console by navigating to **(?) Help → Command Line Tools → Copy Login Command**.

3. Log in to the cluster, passing in the token to authenticate.

```
$ oc login --token=<token>
```

NOTE

This identity provider does not support logging in with a user name and password.

4. Confirm that the user logged in successfully, and display the user name.

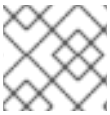
```
$ oc whoami
```

4.7. CONFIGURING A GITLAB IDENTITY PROVIDER

Configure a **gitlab** identity provider to use GitLab.com or any other GitLab instance as an identity provider. If you use GitLab version 7.7.0 to 11.0, you connect using the OAuth integration. If you use GitLab version 11.1 or later, you can use OpenID Connect (OIDC) to connect instead of OAuth.

4.7.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.



NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.7.2. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.7.3. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

NOTE

This procedure is only required for GitHub Enterprise.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.7.4. Sample GitLab CR

The following custom resource (CR) shows the parameters and acceptable values for a GitLab identity provider.

GitLab CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: gitlabidp (1)
    mappingMethod: claim (2)
    type: GitLab
    gitlab:
      clientID: {...} (3)
      clientSecret: (4)
```

```
    name: gitlab-secret
  url: https://gitlab.com 5
  ca: 6
    name: ca-config-map
```

1. This provider name is prefixed to the GitLab numeric user ID to form an identity name. It is also used to build the callback URL.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. The client ID of a registered GitLab OAuth application. The application must be configured with a callback URL of **https://oauth-openshift.apps.<cluster-name>.<cluster-domain>/oauth2callback/<idp-provider-name>**.
4. Reference to an OpenShift Container Platform **Secret** object containing the client secret issued by GitLab.
5. The host URL of a GitLab provider. This could either be **https://gitlab.com/** or any other self hosted instance of GitLab.
6. Optional: Reference to an OpenShift Container Platform **ConfigMap** object containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.7.5. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

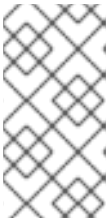
Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Log in to the cluster as a user from your identity provider, entering the password when prompted.

```
$ oc login -u <username>
```

3. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

4.8. CONFIGURING A GOOGLE IDENTITY PROVIDER

Configure a **google** identity provider using Google's OpenID Connect integration.

NOTE

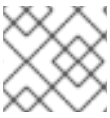
Using Google as an identity provider requires users to get a token using **<master>/oauth/token/request** to use with command-line tools.

WARNING

Using Google as an identity provider allows any Google user to authenticate to your server. You can limit authentication to members of a specific hosted domain with the **hostedDomain** configuration attribute.

4.8.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.



NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.8.2. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.8.3. Sample Google CR

The following custom resource (CR) shows the parameters and acceptable values for a Google identity provider.

Google CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: googleidp 1
    mappingMethod: claim 2
    type: Google
    google:
      clientID: {...} 3
      clientSecret: 4
        name: google-secret
      hostedDomain: "example.com" 5
```

1. This provider name is prefixed to the Google numeric user ID to form an identity name. It is also used to build the redirect URL.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. The client ID of a registered Google project. The project must be configured with a redirect URI of **https://oauth-openshift.apps.<cluster-name>.<cluster-domain>/oauth2callback/<idp-provider-name>**.
4. Reference to an OpenShift Container Platform **Secret** object containing the client secret issued by Google.
5. A hosted domain used to restrict sign-in accounts. Optional if the **lookup mappingMethod** is used. If empty, any Google account is allowed to authenticate.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.8.4. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

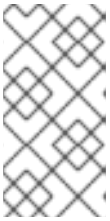
Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Obtain a token from the OAuth server.
   As long as the **kubeadmin** user has been removed, the **oc login** command provides instructions on how to access a web page where you can retrieve the token.

   You can also access this page from the web console by navigating to **(?) Help → Command Line Tools → Copy Login Command**.

3. Log in to the cluster, passing in the token to authenticate.

```
$ oc login --token=<token>
```

NOTE

This identity provider does not support logging in with a user name and password.

4. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

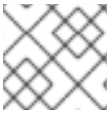
4.9. CONFIGURING A OPENID CONNECT IDENTITY PROVIDER

Configure an **oidc** identity provider to integrate with an OpenID Connect identity provider using an Authorization Code Flow.

You can configure Red Hat Single Sign-On as an OpenID Connect identity provider for OpenShift Container Platform.

IMPORTANT

The Authentication Operator in OpenShift Container Platform requires that the configured OpenID Connect identity provider implements the OpenID Connect Discovery specification.



NOTE

ID Token and **UserInfo** decryptions are not supported.

By default, the **openid** scope is requested. If required, extra scopes can be specified in the **extraScopes** field.

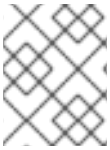
Claims are read from the JWT **id_token** returned from the OpenID identity provider and, if specified, from the JSON returned by the **UserInfo** URL.

At least one claim must be configured to use as the user's identity. The standard identity claim is **sub**.

You can also indicate which claims to use as the user's preferred user name, display name, and email address. If multiple claims are specified, the first one with a non-empty value is used. The standard claims are:

Claim	Description
sub	Short for "subject identifier." The remote identity for the user at the issuer.
preferred_username	The preferred user name when provisioning a user. A shorthand name that the user wants to be referred to as, such as **janedoe**. Typically a value that corresponding to the user's login or username in the authentication system, such as username or email.
email	Email address.
name	Display name.

See the OpenID claims documentation for more information.



NOTE

Using an OpenID Connect identity provider requires users to get a token using **<master>/oauth/token/request** to use with command-line tools.

4.9.1. About identity providers in OpenShift Container Platform

By default, only a **kubeadmin** user exists on your cluster. To specify an identity provider, you must create a custom resource (CR) that describes that identity provider and add it to the cluster.

NOTE

OpenShift Container Platform user names containing /, **:**, and **%** are not supported.

4.9.2. Creating the secret

Identity providers use OpenShift Container Platform **Secret** objects in the **openshift-config** namespace to contain the client secret, client certificates, and keys.

- You can define an OpenShift Container Platform **Secret** object containing a string by using the following command.

```
$ oc create secret generic <secret_name> --from-literal=clientSecret=<secret> -n openshift-config
```

- You can define an OpenShift Container Platform **Secret** object containing the contents of a file, such as a certificate file, by using the following command.

```
$ oc create secret generic <secret_name> --from-file=/path/to/file -n openshift-config
```

4.9.3. Creating a config map

Identity providers use OpenShift Container Platform **ConfigMap** objects in the **openshift-config** namespace to contain the certificate authority bundle. These are primarily used to contain certificate bundles needed by the identity provider.

NOTE

This procedure is only required for GitHub Enterprise.

Procedure

- Define an OpenShift Container Platform **ConfigMap** object containing the certificate authority by using the following command. The certificate authority must be stored in the **ca.crt** key of the **ConfigMap** object.

```
$ oc create configmap ca-config-map --from-file=ca.crt=/path/to/ca -n openshift-config
```

4.9.4. Sample OpenID Connect CRs

The following custom resources (CRs) show the parameters and acceptable values for an OpenID Connect identity provider.

If you must specify a custom certificate bundle, extra scopes, extra authorization request parameters, or a **userInfo** URL, use the full OpenID Connect CR.

Standard OpenID Connect CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: oidcidp (1)
    mappingMethod: claim (2)
    type: OpenID
    openID:
      clientID: ... (3)
      clientSecret: (4)
        name: idp-secret
      claims: (5)
        preferredUsername:
        - preferred_username
        name:
        - name
```

```
      email:
      - email
    issuer: https://www.idp-issuer.com 6
```

1. This provider name is prefixed to the value of the identity claim to form an identity name. It is also used to build the redirect URL.
2. Controls how mappings are established between this provider's identities and **User** objects.
3. The client ID of a client registered with the OpenID provider. The client must be allowed to redirect to **https://oauth-openshift.apps.<cluster_name>.<cluster_domain>/oauth2callback/<idp_provider_name>**.
4. Reference to an OpenShift Container Platform **Secret** object containing the client secret.
5. List of claims to use as the identity. First non-empty claim is used. At least one claim is required. If none of the listed claims have a value, authentication fails. For example, this uses the value of the **sub** claim in the returned **id_token** as the user's identity.
6. Issuer Identifier described in the OpenID spec. Must use **https** without query or fragment component.

Full OpenID Connect CR

```
apiVersion: config.openshift.io/v1
kind: OAuth
metadata:
  name: cluster
spec:
  identityProviders:
  - name: oidcidp
    mappingMethod: claim
    type: OpenID
    openID:
      clientID: ...
      clientSecret:
        name: idp-secret
      ca: 1
        name: ca-config-map
      extraScopes: 2
      - email
      - profile
      extraAuthorizeParameters: 3
        include_granted_scopes: "true"
      claims:
        preferredUsername: 4
        - preferred_username
        - email
        name: 5
        - nickname
        - given_name
        - name
        email: 6
```

```
    - custom_email_claim
    - email
  issuer: https://www.idp-issuer.com
```

1. Optional: Reference to an OpenShift Container Platform config map containing the PEM-encoded certificate authority bundle to use in validating server certificates for the configured URL.
2. Optional list of scopes to request, in addition to the **openid** scope, during the authorization token request.
3. Optional map of extra parameters to add to the authorization token request.
4. List of claims to use as the preferred user name when provisioning a user for this identity. First non-empty claim is used.
5. List of claims to use as the display name. First non-empty claim is used.
6. List of claims to use as the email address. First non-empty claim is used.

Additional resources

- See Identity provider parameters for information on parameters, such as **mappingMethod**, that are common to all identity providers.

4.9.5. Adding an identity provider to your clusters

After you install your cluster, add an identity provider to it so your users can authenticate.

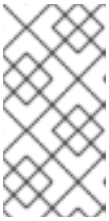
Prerequisites

- Create an OpenShift Container Platform cluster.
- Create the custom resource (CR) for your identity providers.
- You must be logged in as an administrator.

Procedure

1. Apply the defined CR:

```
$ oc apply -f </path/to/CR>
```



NOTE

If a CR does not exist, **oc apply** creates a new CR and might trigger the following warning: **Warning: oc apply should be used on resources created by either oc create --save-config or oc apply**. In this case you can safely ignore this warning.

2. Obtain a token from the OAuth server.
   As long as the **kubeadmin** user has been removed, the **oc login** command provides instructions on how to access a web page where you can retrieve the token.

You can also access this page from the web console by navigating to **(?) Help → Command Line Tools → Copy Login Command**.

3. Log in to the cluster, passing in the token to authenticate.

```
$ oc login --token=<token>
```

NOTE

If your OpenID Connect identity provider supports the resource owner password credentials (ROPC) grant flow, you can log in with a user name and password. You might need to take steps to enable the ROPC grant flow for your identity provider.

After the OIDC identity provider is configured in OpenShift Container Platform, you can log in by using the following command, which prompts for your user name and password:

```
$ oc login -u <identity_provider_username> --server=
<api_server_url_and_port>
```

4. Confirm that the user logged in successfully, and display the user name.

```
$ oc whoami
```

4.9.6. Configuring identity providers using the web console

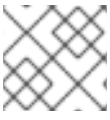
Configure your identity provider (IDP) through the web console instead of the CLI.

Prerequisites

- You must be logged in to the web console as a cluster administrator.

Procedure

1. Navigate to **Administration → Cluster Settings**.
2. Under the **Global Configuration** tab, click **OAuth**.
3. Under the **Identity Providers** section, select your identity provider from the **Add** drop-down menu.



NOTE

You can specify multiple IDPs through the web console without overwriting existing IDPs.

CHAPTER 5. USING RBAC TO DEFINE AND APPLY PERMISSIONS

5.1. RBAC OVERVIEW

Role-based access control (RBAC) objects determine whether a user is allowed to perform a given action within a project.

Cluster administrators can use the cluster roles and bindings to control who has various access levels to the OpenShift Container Platform platform itself and all projects.

Developers can use local roles and bindings to control who has access to their projects. Note that authorization is a separate step from authentication, which is more about determining the identity of who is taking the action.

Authorization is managed using:

Authorization object	Description
Rules	Sets of permitted verbs on a set of objects. For example, whether a user or service account can **create** pods.
Roles	Collections of rules. You can associate, or bind, users and groups to multiple roles.
Bindings	Associations between users and/or groups with a role.

There are two levels of RBAC roles and bindings that control authorization:

RBAC level	Description
Cluster RBAC	Roles and bindings that are applicable across all projects. *Cluster roles* exist cluster-wide, and *cluster role bindings* can reference only cluster roles.
Local RBAC	Roles and bindings that are scoped to a given project. While *local roles* exist only in a single project, local role bindings can reference *both* cluster and local roles.

A cluster role binding is a binding that exists at the cluster level. A role binding exists at the project level. The cluster role *view* must be bound to a user using a local role binding for that user to view the project. Create local roles only if a cluster role does not provide the set of permissions needed for a particular situation.

This two-level hierarchy allows reuse across multiple projects through the cluster roles while allowing customization inside of individual projects through local roles.

During evaluation, both the cluster role bindings and the local role bindings are used. For example:

1. Cluster-wide "allow" rules are checked.
2. Locally-bound "allow" rules are checked.

3. Deny by default.

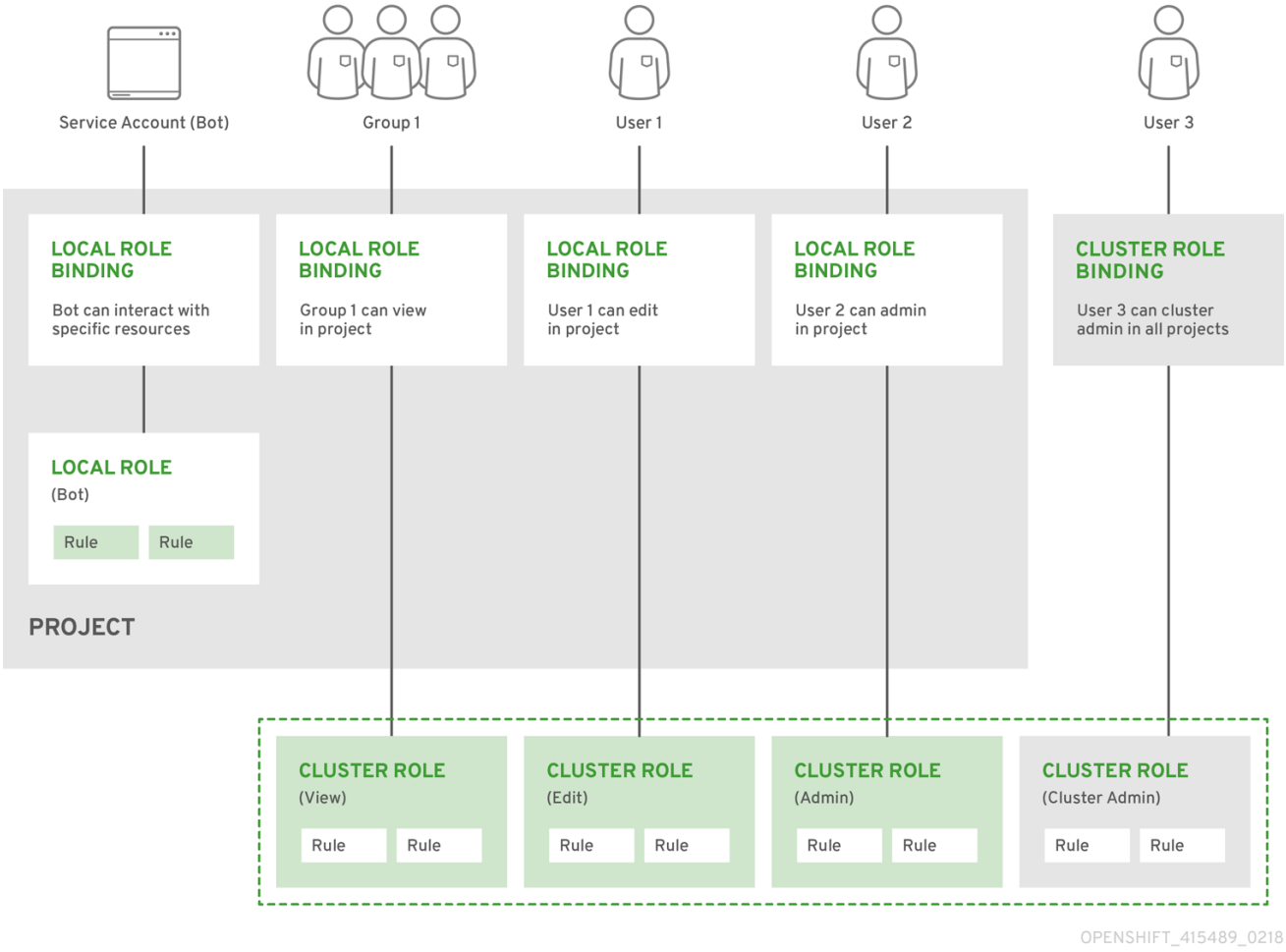
5.1.1. Default cluster roles

OpenShift Container Platform includes a set of default cluster roles that you can bind to users and groups cluster-wide or locally. You can manually modify the default cluster roles, if required.

Default cluster role	Description
admin	A project manager. If used in a local binding, an **admin** has rights to view any resource in the project and modify any resource in the project except for quota.
basic-user	A user that can get basic information about projects and users.
cluster-admin	A super-user that can perform any action in any project. When bound to a user with a local binding, they have full control over quota and every action on every resource in the project.
cluster-status	A user that can get basic cluster status information.
edit	A user that can modify most objects in a project but does not have the power to view or modify roles or bindings.
self-provisioner	A user that can create their own projects.
view	A user who cannot make any modifications, but can see most objects in a project. They cannot view or modify roles or bindings.

Be mindful of the difference between local and cluster bindings. For example, if you bind the **cluster-admin** role to a user by using a local role binding, it might appear that this user has the privileges of a cluster administrator. This is not the case. Binding the **cluster-admin** to a user in a project grants super administrator privileges for only that project to the user. That user has the permissions of the cluster role **admin**, plus a few additional permissions like the ability to edit rate limits, for that project. This binding can be confusing via the web console UI, which does not list cluster role bindings that are bound to true cluster administrators. However, it does list local role bindings that you can use to locally bind **cluster-admin**.

The relationships between cluster roles, local roles, cluster role bindings, local role bindings, users, groups and service accounts are illustrated below.



5.1.2. Evaluating authorization

OpenShift Container Platform evaluates authorization by using:

Identity

The user name and list of groups that the user belongs to.

Action

The action you perform. In most cases, this consists of:

- **Project**: The project you access. A project is a Kubernetes namespace with additional annotations that allows a community of users to organize and manage their content in isolation from other communities.
- **Verb** : The action itself: **get**, **list**, **create**, **update**, **delete**, **deletecollection**, or **watch**.
- **Resource name**: The API endpoint that you access.

Bindings

The full list of bindings, the associations between users or groups with a role.

OpenShift Container Platform evaluates authorization by using the following steps:

1. The identity and the project-scoped action is used to find all bindings that apply to the user or their groups.
2. Bindings are used to locate all the roles that apply.

3. Roles are used to find all the rules that apply.
4. The action is checked against each rule to find a match.
5. If no matching rule is found, the action is then denied by default.

TIP

Remember that users and groups can be associated with, or bound to, multiple roles at the same time.

Project administrators can use the CLI to view local roles and bindings, including a matrix of the verbs and resources each are associated with.

IMPORTANT

The cluster role bound to the project administrator is limited in a project through a local binding. It is not bound cluster-wide like the cluster roles granted to the **cluster-admin** or **system:admin**.

Cluster roles are roles defined at the cluster level but can be bound either at the cluster level or at the project level.

5.1.2.1. Cluster role aggregation

The default admin, edit, view, and cluster-reader cluster roles support cluster role aggregation, where the cluster rules for each role are dynamically updated as new rules are created. This feature is relevant only if you extend the Kubernetes API by creating custom resources.

5.2. PROJECTS AND NAMESPACES

A Kubernetes *namespace* provides a mechanism to scope resources in a cluster. The Kubernetes documentation has more information on namespaces.

Namespaces provide a unique scope for:

- Named resources to avoid basic naming collisions.
- Delegated management authority to trusted users.
- The ability to limit community resource consumption.

Most objects in the system are scoped by namespace, but some are excepted and have no namespace, including nodes and users.

A *project* is a Kubernetes namespace with additional annotations and is the central vehicle by which access to resources for regular users is managed. A project allows a community of users to organize and manage their content in isolation from other communities. Users must be given access to projects by administrators, or if allowed to create projects, automatically have access to their own projects.

Projects can have a separate **name**, **displayName**, and **description**.

- The mandatory **name** is a unique identifier for the project and is most visible when using the CLI tools or API. The maximum name length is 63 characters.

- The optional **displayName** is how the project is displayed in the web console (defaults to **name**).
- The optional **description** can be a more detailed description of the project and is also visible in the web console.

Each project scopes its own set of:

Object	Description
Objects	Pods, services, replication controllers, etc.
Policies	Rules for which users can or cannot perform actions on objects.
Constraints	Quotas for each kind of object that can be limited.
Service accounts	Service accounts act automatically with designated access to objects in the project.

Cluster administrators can create projects and delegate administrative rights for the project to any member of the user community. Cluster administrators can also allow developers to create their own projects.

Developers and administrators can interact with projects by using the CLI or the web console.

5.3. DEFAULT PROJECTS

OpenShift Container Platform comes with a number of default projects, and projects starting with **openshift-** are the most essential to users. These projects host master components that run as pods and other infrastructure components. The pods created in these namespaces that have a critical pod annotation are considered critical, and the have guaranteed admission by kubelet. Pods created for master components in these namespaces are already marked as critical.

NOTE

You cannot assign an SCC to pods created in one of the default namespaces: **default**, **kube-system**, **kube-public**, **openshift-node**, **openshift-infra**, and **openshift**. You cannot use these namespaces for running pods or services.

5.4. VIEWING CLUSTER ROLES AND BINDINGS

You can use the **oc** CLI to view cluster roles and bindings by using the **oc describe** command.

Prerequisites

- Install the **oc** CLI.
- Obtain permission to view the cluster roles and bindings.

Users with the **cluster-admin** default cluster role bound cluster-wide can perform any action on any resource, including viewing cluster roles and bindings.

Procedure

1. To view the cluster roles and their associated rule sets:

```
$ oc describe clusterrole.rbac
```

Example output

```
Name:         admin
Labels:       kubernetes.io/bootstrapping=rbac-defaults
Annotations:  rbac.authorization.kubernetes.io/autoupdate: true
PolicyRule:
  Resources                                  Non-Resource URLs  Resource Names  Verbs
  ---------                                  -----------------  --------------  -----
  .packages.apps.redhat.com                  []                 []              [* create update
patch delete get list watch]
  imagestreams                               []                 []              [create delete
deletecollection get list patch update watch create get list watch]
  imagestreams.image.openshift.io            []                 []              [create delete
deletecollection get list patch update watch create get list watch]
  secrets                                    []                 []              [create delete deletecollection
get list patch update watch get list watch create delete deletecollection patch update]
  buildconfigs/webhooks                      []                 []              [create delete
deletecollection get list patch update watch get list watch]
  buildconfigs                               []                 []              [create delete
deletecollection get list patch update watch get list watch]
  buildlogs                                  []                 []              [create delete deletecollection
get list patch update watch get list watch]
  deploymentconfigs/scale                    []                 []              [create delete
deletecollection get list patch update watch get list watch]
  deploymentconfigs                          []                 []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreamimages                          []                 []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreammappings                        []                 []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreamtags                            []                 []              [create delete
deletecollection get list patch update watch get list watch]
  processedtemplates                         []                 []              [create delete
deletecollection get list patch update watch get list watch]
  routes                                     []                 []              [create delete deletecollection
get list patch update watch get list watch]
  templateconfigs                            []                 []              [create delete
deletecollection get list patch update watch get list watch]
  templateinstances                          []                 []              [create delete
deletecollection get list patch update watch get list watch]
  templates                                  []                 []              [create delete
deletecollection get list patch update watch get list watch]
  deploymentconfigs.apps.openshift.io/scale  []                 []              [create delete
deletecollection get list patch update watch get list watch]
  deploymentconfigs.apps.openshift.io        []                 []              [create delete
deletecollection get list patch update watch get list watch]
  buildconfigs.build.openshift.io/webhooks   []                 []              [create delete
deletecollection get list patch update watch get list watch]
  buildconfigs.build.openshift.io            []                 []              [create delete
deletecollection get list patch update watch get list watch]
```

```
  buildlogs.build.openshift.io                    []                []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreamimages.image.openshift.io            []                []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreammappings.image.openshift.io          []                []              [create delete
deletecollection get list patch update watch get list watch]
  imagestreamtags.image.openshift.io              []                []              [create delete
deletecollection get list patch update watch get list watch]
  routes.route.openshift.io                       []                []              [create delete
deletecollection get list patch update watch get list watch]
  processedtemplates.template.openshift.io        []                []              [create delete
deletecollection get list patch update watch get list watch]
  templateconfigs.template.openshift.io           []                []              [create delete
deletecollection get list patch update watch get list watch]
  templateinstances.template.openshift.io         []                []              [create delete
deletecollection get list patch update watch get list watch]
  templates.template.openshift.io                 []                []              [create delete
deletecollection get list patch update watch get list watch]
  serviceaccounts                                 []                []              [create delete
deletecollection get list patch update watch impersonate create delete deletecollection patch
update get list watch]
  imagestreams/secrets                            []                []              [create delete
deletecollection get list patch update watch]
  rolebindings                                    []                []              [create delete
deletecollection get list patch update watch]
  roles                                           []                []              [create delete deletecollection
get list patch update watch]
  rolebindings.authorization.openshift.io         []                []              [create delete
deletecollection get list patch update watch]
  roles.authorization.openshift.io                []                []              [create delete
deletecollection get list patch update watch]
  imagestreams.image.openshift.io/secrets         []                []              [create delete
deletecollection get list patch update watch]
  rolebindings.rbac.authorization.k8s.io          []                []              [create delete
deletecollection get list patch update watch]
  roles.rbac.authorization.k8s.io                 []                []              [create delete
deletecollection get list patch update watch]
  networkpolicies.extensions                      []                []              [create delete
deletecollection patch update create delete deletecollection get list patch update watch get
list watch]
  networkpolicies.networking.k8s.io               []                []              [create delete
deletecollection patch update create delete deletecollection get list patch update watch get
list watch]
  configmaps                                      []                []              [create delete
deletecollection patch update get list watch]
  endpoints                                       []                []              [create delete
deletecollection patch update get list watch]
  persistentvolumeclaims                          []                []              [create delete
deletecollection patch update get list watch]
  pods                                            []                []              [create delete deletecollection
patch update get list watch]
  replicationcontrollers/scale                    []                []              [create delete
deletecollection patch update get list watch]
  replicationcontrollers                          []                []              [create delete
deletecollection patch update get list watch]
  services                                        []                []              [create delete deletecollection
```

```
patch update get list watch]
  daemonsets.apps                                 []              []              [create delete
deletecollection patch update get list watch]
  deployments.apps/scale                          []              []              [create delete
deletecollection patch update get list watch]
  deployments.apps                                []              []              [create delete
deletecollection patch update get list watch]
  replicasets.apps/scale                          []              []              [create delete
deletecollection patch update get list watch]
  replicasets.apps                                []              []              [create delete
deletecollection patch update get list watch]
  statefulsets.apps/scale                         []              []              [create delete
deletecollection patch update get list watch]
  statefulsets.apps                               []              []              [create delete
deletecollection patch update get list watch]
  horizontalpodautoscalers.autoscaling            []              []              [create delete
deletecollection patch update get list watch]
  cronjobs.batch                                  []              []              [create delete
deletecollection patch update get list watch]
  jobs.batch                                      []              []              [create delete
deletecollection patch update get list watch]
  daemonsets.extensions                           []              []              [create delete
deletecollection patch update get list watch]
  deployments.extensions/scale                    []              []              [create delete
deletecollection patch update get list watch]
  deployments.extensions                          []              []              [create delete
deletecollection patch update get list watch]
  ingresses.extensions                            []              []              [create delete
deletecollection patch update get list watch]
  replicasets.extensions/scale                    []              []              [create delete
deletecollection patch update get list watch]
  replicasets.extensions                          []              []              [create delete
deletecollection patch update get list watch]
  replicationcontrollers.extensions/scale         []              []              [create delete
deletecollection patch update get list watch]
  poddisruptionbudgets.policy                     []              []              [create delete
deletecollection patch update get list watch]
  deployments.apps/rollback                       []              []              [create delete
deletecollection patch update]
  deployments.extensions/rollback                 []              []              [create delete
deletecollection patch update]
  catalogsources.operators.coreos.com             []              []              [create update
patch delete get list watch]
  clusterserviceversions.operators.coreos.com     []              []              [create update
patch delete get list watch]
  installplans.operators.coreos.com               []              []              [create update
patch delete get list watch]
  packagemanifests.operators.coreos.com           []              []              [create update
patch delete get list watch]
  subscriptions.operators.coreos.com              []              []              [create update
patch delete get list watch]
  buildconfigs/instantiate                        []              []              [create]
  buildconfigs/instantiatebinary                  []              []              [create]
  builds/clone                                    []              []              [create]
  deploymentconfigrollbacks                       []              []              [create]
  deploymentconfigs/instantiate                   []              []              [create]
```

```
  deploymentconfigs/rollback                                  []                []              [create]
  imagestreamimports                                          []                []              [create]
  localresourceaccessreviews                                  []                []              [create]
  localsubjectaccessreviews                                   []                []              [create]
  podsecuritypolicyreviews                                    []                []              [create]
  podsecuritypolicyselfsubjectreviews                         []                []              [create]
  podsecuritypolicysubjectreviews                             []                []              [create]
  resourceaccessreviews                                       []                []              [create]
  routes/custom-host                                          []                []              [create]
  subjectaccessreviews                                        []                []              [create]
  subjectrulesreviews                                         []                []              [create]
  deploymentconfigrollbacks.apps.openshift.io                 []                []              [create]
  deploymentconfigs.apps.openshift.io/instantiate             []                []              [create]
  deploymentconfigs.apps.openshift.io/rollback                []                []              [create]
  localsubjectaccessreviews.authorization.k8s.io              []                []              [create]
  localresourceaccessreviews.authorization.openshift.io       []                []              [create]
  localsubjectaccessreviews.authorization.openshift.io        []                []              [create]
  resourceaccessreviews.authorization.openshift.io            []                []              [create]
  subjectaccessreviews.authorization.openshift.io             []                []              [create]
  subjectrulesreviews.authorization.openshift.io              []                []              [create]
  buildconfigs.build.openshift.io/instantiate                 []                []              [create]
  buildconfigs.build.openshift.io/instantiatebinary           []                []              [create]
  builds.build.openshift.io/clone                             []                []              [create]
  imagestreamimports.image.openshift.io                       []                []              [create]
  routes.route.openshift.io/custom-host                       []                []              [create]
  podsecuritypolicyreviews.security.openshift.io              []                []              [create]
  podsecuritypolicyselfsubjectreviews.security.openshift.io   []                []              [create]
  podsecuritypolicysubjectreviews.security.openshift.io       []                []              [create]
  jenkins.build.openshift.io                                  []                []              [edit view view admin
edit view]
  builds                                                      []                []              [get create delete
deletecollection get list patch update watch get list watch]
  builds.build.openshift.io                                   []                []              [get create delete
deletecollection get list patch update watch get list watch]
  projects                                                    []                []              [get delete get delete get patch
update]
  projects.project.openshift.io                               []                []              [get delete get delete
get patch update]
  namespaces                                                  []                []              [get get list watch]
  pods/attach                                                 []                []              [get list watch create delete
deletecollection patch update]
  pods/exec                                                   []                []              [get list watch create delete
deletecollection patch update]
  pods/portforward                                            []                []              [get list watch create
delete deletecollection patch update]
  pods/proxy                                                  []                []              [get list watch create delete
deletecollection patch update]
  services/proxy                                              []                []              [get list watch create delete
deletecollection patch update]
  routes/status                                               []                []              [get list watch update]
  routes.route.openshift.io/status                            []                []              [get list watch update]
  appliedclusterresourcequotas                                []                []              [get list watch]
  bindings                                                    []                []              [get list watch]
  builds/log                                                  []                []              [get list watch]
  deploymentconfigs/log                                       []                []              [get list watch]
  deploymentconfigs/status                                    []                []              [get list watch]
```

```
  events                                                []                []              [get list watch]
  imagestreams/status                                   []                []              [get list watch]
  limitranges                                           []                []              [get list watch]
  namespaces/status                                     []                []              [get list watch]
  pods/log                                              []                []              [get list watch]
  pods/status                                           []                []              [get list watch]
  replicationcontrollers/status                         []                []              [get list watch]
  resourcequotas/status                                 []                []              [get list watch]
  resourcequotas                                        []                []              [get list watch]
  resourcequotausages                                   []                []              [get list watch]
  rolebindingrestrictions                               []                []              [get list watch]
  deploymentconfigs.apps.openshift.io/log               []                []              [get list watch]
  deploymentconfigs.apps.openshift.io/status            []                []              [get list watch]
  controllerrevisions.apps                              []                []              [get list watch]
  rolebindingrestrictions.authorization.openshift.io    []                []              [get list watch]
  builds.build.openshift.io/log                         []                []              [get list watch]
  imagestreams.image.openshift.io/status                []                []              [get list watch]
  appliedclusterresourcequotas.quota.openshift.io       []                []              [get list watch]
  imagestreams/layers                                   []                []              [get update get]
  imagestreams.image.openshift.io/layers                []                []              [get update get]
  builds/details                                        []                []              [update]
  builds.build.openshift.io/details                     []                []              [update]


Name:         basic-user
Labels:       <none>
Annotations:  openshift.io/description: A user that can get basic information about projects.
              rbac.authorization.kubernetes.io/autoupdate: true
PolicyRule:
 Resources                                    Non-Resource URLs  Resource Names  Verbs
  ---------                                   -----------------  --------------  -----
  selfsubjectrulesreviews                     []                 []              [create]
  selfsubjectaccessreviews.authorization.k8s.io  []              []              [create]
  selfsubjectrulesreviews.authorization.openshift.io  []          []              [create]
  clusterroles.rbac.authorization.k8s.io      []                 []              [get list watch]
  clusterroles                                []                 []              [get list]
  clusterroles.authorization.openshift.io     []                 []              [get list]
  storageclasses.storage.k8s.io               []                 []              [get list]
  users                                       []                 [~]             [get]
  users.user.openshift.io                     []                 [~]             [get]
  projects                                    []                 []              [list watch]
  projects.project.openshift.io               []                 []              [list watch]
  projectrequests                             []                 []              [list]
  projectrequests.project.openshift.io        []                 []              [list]

Name:         cluster-admin
Labels:       kubernetes.io/bootstrapping=rbac-defaults
Annotations:  rbac.authorization.kubernetes.io/autoupdate: true
PolicyRule:
Resources  Non-Resource URLs  Resource Names  Verbs
---------  -----------------  --------------  -----
*.*        []                 []              [*]
           [*]                []              [*]

...
```

2. To view the current set of cluster role bindings, which shows the users and groups that are bound to various roles:

```
$ oc describe clusterrolebinding.rbac
```

Example output

```
Name:         alertmanager-main
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  alertmanager-main
Subjects:
  Kind            Name              Namespace
  ----            ----              ---------
  ServiceAccount  alertmanager-main  openshift-monitoring


Name:         basic-users
Labels:       <none>
Annotations:  rbac.authorization.kubernetes.io/autoupdate: true
Role:
  Kind:  ClusterRole
  Name:  basic-user
Subjects:
  Kind   Name                Namespace
  ----   ----                ---------
  Group  system:authenticated


Name:         cloud-credential-operator-rolebinding
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  cloud-credential-operator-role
Subjects:
  Kind            Name     Namespace
  ----            ----     ---------
  ServiceAccount  default  openshift-cloud-credential-operator


Name:         cluster-admin
Labels:       kubernetes.io/bootstrapping=rbac-defaults
Annotations:  rbac.authorization.kubernetes.io/autoupdate: true
Role:
  Kind:  ClusterRole
  Name:  cluster-admin
Subjects:
  Kind   Name            Namespace
  ----   ----            ---------
  Group  system:masters
```

```
Name:         cluster-admins
Labels:       <none>
Annotations:  rbac.authorization.kubernetes.io/autoupdate: true
Role:
  Kind:  ClusterRole
  Name:  cluster-admin
Subjects:
  Kind   Name                Namespace
  ----   ----                ---------
  Group  system:cluster-admins
  User   system:admin


Name:         cluster-api-manager-rolebinding
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  cluster-api-manager-role
Subjects:
  Kind           Name     Namespace
  ----           ----     ---------
  ServiceAccount  default  openshift-machine-api

...
```

5.5. VIEWING LOCAL ROLES AND BINDINGS

You can use the **oc** CLI to view local roles and bindings by using the **oc describe** command.

Prerequisites

- Install the **oc** CLI.
- Obtain permission to view the local roles and bindings:
  - Users with the **cluster-admin** default cluster role bound cluster-wide can perform any action on any resource, including viewing local roles and bindings.
  - Users with the **admin** default cluster role bound locally can view and manage roles and bindings in that project.

Procedure

1. To view the current set of local role bindings, which show the users and groups that are bound to various roles for the current project:

```
$ oc describe rolebinding.rbac
```

2. To view the local role bindings for a different project, add the **-n** flag to the command:

```
$ oc describe rolebinding.rbac -n joe-project
```

Example output

```
Name:         admin
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  admin
Subjects:
  Kind  Name        Namespace
  ----  ----        ---------
  User  kube:admin


Name:         system:deployers
Labels:       <none>
Annotations:  openshift.io/description:
              Allows deploymentconfigs in this namespace to rollout pods in
              this namespace.  It is auto-managed by a controller; remove
              subjects to disa...
Role:
  Kind:  ClusterRole
  Name:  system:deployer
Subjects:
  Kind           Name      Namespace
  ----           ----      ---------
  ServiceAccount  deployer  joe-project


Name:         system:image-builders
Labels:       <none>
Annotations:  openshift.io/description:
              Allows builds in this namespace to push images to this
              namespace.  It is auto-managed by a controller; remove subjects
              to disable.
Role:
  Kind:  ClusterRole
  Name:  system:image-builder
Subjects:
  Kind           Name     Namespace
  ----           ----     ---------
  ServiceAccount  builder  joe-project


Name:         system:image-pullers
Labels:       <none>
Annotations:  openshift.io/description:
              Allows all pods in this namespace to pull images from this
              namespace.  It is auto-managed by a controller; remove subjects
              to disable.
Role:
  Kind:  ClusterRole
  Name:  system:image-puller
Subjects:
  Kind   Name                         Namespace
  ----   ----                         ---------
  Group  system:serviceaccounts:joe-project
```

5.6. ADDING ROLES TO USERS

You can use the **oc adm** administrator CLI to manage the roles and bindings.

Binding, or adding, a role to users or groups gives the user or group the access that is granted by the role. You can add and remove roles to and from users and groups using **oc adm policy** commands.

You can bind any of the default cluster roles to local users or groups in your project.

Procedure

1. Add a role to a user in a specific project:

```
$ oc adm policy add-role-to-user <role> <user> -n <project>
```

   For example, you can add the **admin** role to the **alice** user in **joe** project by running:

```
$ oc adm policy add-role-to-user admin alice -n joe
```

2. View the local role bindings and verify the addition in the output:

```
$ oc describe rolebinding.rbac -n <project>
```

   For example, to view the local role bindings for the **joe** project:

```
$ oc describe rolebinding.rbac -n joe
```

   #### Example output

```
Name:         admin
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  admin
Subjects:
  Kind  Name        Namespace
  ----  ----        ---------
  User  kube:admin


Name:         admin-0
Labels:       <none>
Annotations:  <none>
Role:
  Kind:  ClusterRole
  Name:  admin
Subjects:
  Kind  Name   Namespace
  ----  ----   ---------
  User  alice  (1)


Name:         system:deployers
```

```
Labels:      <none>
Annotations:  openshift.io/description:
              Allows deploymentconfigs in this namespace to rollout pods in
              this namespace.  It is auto-managed by a controller; remove
              subjects to disa...
Role:
  Kind:  ClusterRole
  Name:  system:deployer
Subjects:
  Kind           Name      Namespace
  ----           ----      ---------
  ServiceAccount  deployer  joe


Name:         system:image-builders
Labels:       <none>
Annotations:  openshift.io/description:
              Allows builds in this namespace to push images to this
              namespace.  It is auto-managed by a controller; remove subjects
              to disable.
Role:
  Kind:  ClusterRole
  Name:  system:image-builder
Subjects:
  Kind           Name     Namespace
  ----           ----     ---------
  ServiceAccount  builder  joe


Name:         system:image-pullers
Labels:       <none>
Annotations:  openshift.io/description:
              Allows all pods in this namespace to pull images from this
              namespace.  It is auto-managed by a controller; remove subjects
              to disable.
Role:
  Kind:  ClusterRole
  Name:  system:image-puller
Subjects:
  Kind   Name                         Namespace
  ----   ----                         ---------
  Group  system:serviceaccounts:joe
```

1 The **alice** user has been added to the **admins RoleBinding**.

5.7. CREATING A LOCAL ROLE

You can create a local role for a project and then bind it to a user.

Procedure

1. To create a local role for a project, run the following command:

```
$ oc create role <name> --verb=<verb> --resource=<resource> -n <project>
```

In this command, specify:

- **<name>**, the local role's name
- **<verb>**, a comma-separated list of the verbs to apply to the role
- **<resource>**, the resources that the role applies to
- **<project>**, the project name

For example, to create a local role that allows a user to view pods in the **blue** project, run the following command:

```
$ oc create role podview --verb=get --resource=pod -n blue
```

2. To bind the new role to a user, run the following command:

```
$ oc adm policy add-role-to-user podview user2 --role-namespace=blue -n blue
```

5.8. CREATING A CLUSTER ROLE

You can create a cluster role.

Procedure

1. To create a cluster role, run the following command:

```
$ oc create clusterrole <name> --verb=<verb> --resource=<resource>
```

In this command, specify:

- **<name>**, the local role's name
- **<verb>**, a comma-separated list of the verbs to apply to the role
- **<resource>**, the resources that the role applies to

For example, to create a cluster role that allows a user to view pods, run the following command:

```
$ oc create clusterrole podviewonly --verb=get --resource=pod
```

5.9. LOCAL ROLE BINDING COMMANDS

When you manage a user or group's associated roles for local role bindings using the following operations, a project may be specified with the **-n** flag. If it is not specified, then the current project is used.

You can use the following commands for local RBAC management.

Table 5.1. Local role binding operations

Command	Description
$ oc adm policy who-can *<verb> <resource>*	Indicates which users can perform an action on a resource.
$ oc adm policy add-role-to-user *<role> <username>*	Binds a specified role to specified users in the current project.
$ oc adm policy remove-role-from-user *<role> <username>*	Removes a given role from specified users in the current project.
$ oc adm policy remove-user *<username>*	Removes specified users and all of their roles in the current project.
$ oc adm policy add-role-to-group *<role> <groupname>*	Binds a given role to specified groups in the current project.
$ oc adm policy remove-role-from-group *<role> <groupname>*	Removes a given role from specified groups in the current project.
$ oc adm policy remove-group *<groupname>*	Removes specified groups and all of their roles in the current project.

5.10. CLUSTER ROLE BINDING COMMANDS

You can also manage cluster role bindings using the following operations. The **-n** flag is not used for these operations because cluster role bindings use non-namespaced resources.

Table 5.2. Cluster role binding operations

Command	Description
$ oc adm policy add-cluster-role-to-user *<role> <username>*	Binds a given role to specified users for all projects in the cluster.
$ oc adm policy remove-cluster-role-from-user *<role> <username>*	Removes a given role from specified users for all projects in the cluster.
$ oc adm policy add-cluster-role-to-group *<role> <groupname>*	Binds a given role to specified groups for all projects in the cluster.
$ oc adm policy remove-cluster-role-from-group *<role> <groupname>*	Removes a given role from specified groups for all projects in the cluster.

5.11. CREATING A CLUSTER ADMIN

The **cluster-admin** role is required to perform administrator level tasks on the OpenShift Container Platform cluster, such as modifying cluster resources.

Prerequisites

- You must have created a user to define as the cluster admin.

Procedure

- Define the user as a cluster admin:

```
$ oc adm policy add-cluster-role-to-user cluster-admin <user>
```

CHAPTER 6. REMOVING THE KUBEADMIN USER

6.1. THE KUBEADMIN USER

OpenShift Container Platform creates a cluster administrator, **kubeadmin**, after the installation process completes.

This user has the **cluster-admin** role automatically applied and is treated as the root user for the cluster. The password is dynamically generated and unique to your OpenShift Container Platform environment. After installation completes the password is provided in the installation program's output. For example:

```
INFO Install complete!
INFO Run 'export KUBECONFIG=<your working directory>/auth/kubeconfig' to manage the cluster
with 'oc', the OpenShift CLI.
INFO The cluster is ready when 'oc login -u kubeadmin -p <provided>' succeeds (wait a few minutes).
INFO Access the OpenShift web-console here: https://console-openshift-
console.apps.demo1.openshift4-beta-abcorp.com
INFO Login to the console with user: kubeadmin, password: <provided>
```

6.2. REMOVING THE KUBEADMIN USER

After you define an identity provider and create a new **cluster-admin** user, you can remove the **kubeadmin** to improve cluster security.

WARNING

If you follow this procedure before another user is a **cluster-admin**, then OpenShift Container Platform must be reinstalled. It is not possible to undo this command.

Prerequisites

- You must have configured at least one identity provider.
- You must have added the **cluster-admin** role to a user.
- You must be logged in as an administrator.

Procedure

- Remove the **kubeadmin** secrets:

```
$ oc delete secrets kubeadmin -n kube-system
```

CHAPTER 7. UNDERSTANDING AND CREATING SERVICE ACCOUNTS

7.1. SERVICE ACCOUNTS OVERVIEW

A service account is an OpenShift Container Platform account that allows a component to directly access the API. Service accounts are API objects that exist within each project. Service accounts provide a flexible way to control API access without sharing a regular user's credentials.

When you use the OpenShift Container Platform CLI or web console, your API token authenticates you to the API. You can associate a component with a service account so that they can access the API without using a regular user's credentials. For example, service accounts can allow:

- Replication controllers to make API calls to create or delete pods.
- Applications inside containers to make API calls for discovery purposes.
- External applications to make API calls for monitoring or integration purposes.

Each service account's user name is derived from its project and name:

```
system:serviceaccount:<project>:<name>
```

Every service account is also a member of two groups:

Group	Description
system:serviceaccounts	Includes all service accounts in the system.
system:serviceaccounts:<project>	Includes all service accounts in the specified project.

Each service account automatically contains two secrets:

- An API token
- Credentials for the OpenShift Container Registry

The generated API token and registry credentials do not expire, but you can revoke them by deleting the secret. When you delete the secret, a new one is automatically generated to take its place.

7.2. CREATING SERVICE ACCOUNTS

You can create a service account in a project and grant it permissions by binding it to a role.

Procedure

1. Optional: To view the service accounts in the current project:

   ```
   $ oc get sa
   ```

   Example output

```
NAME      SECRETS   AGE
builder   2         2d
default   2         2d
deployer  2         2d
```

2. To create a new service account in the current project:

```
$ oc create sa <service_account_name> 1
```

1 To create a service account in a different project, specify **-n <project_name>**.

Example output

```
serviceaccount "robot" created
```

3. Optional: View the secrets for the service account:

```
$ oc describe sa robot
```

Example output

```
Name:  robot
Namespace: project1
Labels:  <none>
Annotations: <none>

Image pull secrets: robot-dockercfg-qzbhb

Mountable secrets:  robot-token-f4khf
                    robot-dockercfg-qzbhb

Tokens:             robot-token-f4khf
                    robot-token-z8h44
```

7.3. EXAMPLES OF GRANTING ROLES TO SERVICE ACCOUNTS

You can grant roles to service accounts in the same way that you grant roles to a regular user account.

- You can modify the service accounts for the current project. For example, to add the **view** role to the **robot** service account in the **top-secret** project:

```
$ oc policy add-role-to-user view system:serviceaccount:top-secret:robot
```

- You can also grant access to a specific service account in a project. For example, from the project to which the service account belongs, use the **-z** flag and specify the **<service_account_name>**

```
$ oc policy add-role-to-user <role_name> -z <service_account_name>
```

IMPORTANT

If you want to grant access to a specific service account in a project, use the **-z** flag. Using this flag helps prevent typos and ensures that access is granted to only the specified service account.

- To modify a different namespace, you can use the **-n** option to indicate the project namespace it applies to, as shown in the following examples.
  - For example, to allow all service accounts in all projects to view resources in the **top-secret** project:

```
$ oc policy add-role-to-group view system:serviceaccounts -n top-secret
```

  - To allow all service accounts in the **managers** project to edit resources in the **top-secret** project:

```
$ oc policy add-role-to-group edit system:serviceaccounts:managers -n top-secret
```

CHAPTER 8. USING SERVICE ACCOUNTS IN APPLICATIONS

8.1. SERVICE ACCOUNTS OVERVIEW

A service account is an OpenShift Container Platform account that allows a component to directly access the API. Service accounts are API objects that exist within each project. Service accounts provide a flexible way to control API access without sharing a regular user's credentials.

When you use the OpenShift Container Platform CLI or web console, your API token authenticates you to the API. You can associate a component with a service account so that they can access the API without using a regular user's credentials. For example, service accounts can allow:

- Replication controllers to make API calls to create or delete pods.
- Applications inside containers to make API calls for discovery purposes.
- External applications to make API calls for monitoring or integration purposes.

Each service account's user name is derived from its project and name:

```
system:serviceaccount:<project>:<name>
```

Every service account is also a member of two groups:

Group	Description
system:serviceaccounts	Includes all service accounts in the system.
system:serviceaccounts:<project>	Includes all service accounts in the specified project.

Each service account automatically contains two secrets:

- An API token
- Credentials for the OpenShift Container Registry

The generated API token and registry credentials do not expire, but you can revoke them by deleting the secret. When you delete the secret, a new one is automatically generated to take its place.

8.2. DEFAULT SERVICE ACCOUNTS

Your OpenShift Container Platform cluster contains default service accounts for cluster management and generates more service accounts for each project.

8.2.1. Default cluster service accounts

Several infrastructure controllers run using service account credentials. The following service accounts are created in the OpenShift Container Platform infrastructure project (**openshift-infra**) at server start, and given the following roles cluster-wide:

Service Account	Description
replication-controller	Assigned the **system:replication-controller** role
deployment-controller	Assigned the **system:deployment-controller** role
build-controller	Assigned the **system:build-controller** role. Additionally, the **build-controller** service account is included in the privileged security context constraint in order to create privileged build pods.

8.2.2. Default project service accounts and roles

Three service accounts are automatically created in each project:

Service Account	Usage
builder	Used by build pods. It is given the **system:image-builder** role, which allows pushing images to any imagestream in the project using the internal Docker registry.
deployer	Used by deployment pods and given the **system:deployer** role, which allows viewing and modifying replication controllers and pods in the project.
default	Used to run all other pods unless they specify a different service account.

All service accounts in a project are given the **system:image-puller** role, which allows pulling images from any imagestream in the project using the internal container image registry.

8.3. CREATING SERVICE ACCOUNTS

You can create a service account in a project and grant it permissions by binding it to a role.

Procedure

1. Optional: To view the service accounts in the current project:

```
$ oc get sa
```

Example output

```
NAME       SECRETS   AGE
builder    2         2d
default    2         2d
deployer   2         2d
```

2. To create a new service account in the current project:

```
$ oc create sa <service_account_name> 1
```

1 To create a service account in a different project, specify **-n <project_name>**.

Example output

```
serviceaccount "robot" created
```

3. Optional: View the secrets for the service account:

```
$ oc describe sa robot
```

Example output

```
Name:  robot
Namespace: project1
Labels:  <none>
Annotations: <none>

Image pull secrets: robot-dockercfg-qzbhb

Mountable secrets:  robot-token-f4khf
                    robot-dockercfg-qzbhb

Tokens:             robot-token-f4khf
                    robot-token-z8h44
```

8.4. USING A SERVICE ACCOUNT'S CREDENTIALS EXTERNALLY

You can distribute a service account's token to external applications that must authenticate to the API.

In order to pull an image, the authenticated user must have **get** rights on the requested **imagestreams/layers**. In order to push an image, the authenticated user must have **update** rights on the requested **imagestreams/layers**.

By default, all service accounts in a project have rights to pull any image in the same project, and the **builder** service account has rights to push any image in the same project.

Procedure

1. View the service account's API token:

```
$ oc describe secret <secret_name>
```

For example:

```
$ oc describe secret robot-token-uzkbh -n top-secret
```

Example output

```
Name:  robot-token-uzkbh
```

```
Labels:  <none>
Annotations: kubernetes.io/service-account.name=robot,kubernetes.io/service-
account.uid=49f19e2e-16c6-11e5-afdc-3c970e4b7ffe

Type: kubernetes.io/service-account-token

Data

token: eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCJ9...
```

2. Log in using the token that you obtained:

```
$ oc login --token=eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCJ9...
```

Example output

```
Logged into "https://server:8443" as "system:serviceaccount:top-secret:robot" using the
token provided.

You don't have any projects. You can try to create a new project, by running

    $ oc new-project <projectname>
```

3. Confirm that you logged in as the service account:

```
$ oc whoami
```

Example output

```
system:serviceaccount:top-secret:robot
```

CHAPTER 9. USING A SERVICE ACCOUNT AS AN OAUTH CLIENT

9.1. SERVICE ACCOUNTS AS OAUTH CLIENTS

You can use a service account as a constrained form of OAuth client. Service accounts can request only a subset of scopes that allow access to some basic user information and role-based power inside of the service account's own namespace:

- **user:info**
- **user:check-access**
- **role:<any_role>:<service_account_namespace>**
- **role:<any_role>:<service_account_namespace>:!**

When using a service account as an OAuth client:

- **client_id** is **system:serviceaccount:<service_account_namespace>:<service_account_name>**.
- **client_secret** can be any of the API tokens for that service account. For example:

```
$ oc sa get-token <service_account_name>
```

- To get **WWW-Authenticate** challenges, set an **serviceaccounts.openshift.io/oauth-want-challenges** annotation on the service account to **true**.
- **redirect_uri** must match an annotation on the service account.

9.1.1. Redirect URIs for service accounts as OAuth clients

Annotation keys must have the prefix **serviceaccounts.openshift.io/oauth-redirecturi.** or **serviceaccounts.openshift.io/oauth-redirectreference.** such as:

```
serviceaccounts.openshift.io/oauth-redirecturi.<name>
```

In its simplest form, the annotation can be used to directly specify valid redirect URIs. For example:

```
"serviceaccounts.openshift.io/oauth-redirecturi.first":  "https://example.com"
"serviceaccounts.openshift.io/oauth-redirecturi.second": "https://other.com"
```

The **first** and **second** postfixes in the above example are used to separate the two valid redirect URIs.

In more complex configurations, static redirect URIs may not be enough. For example, perhaps you want all Ingresses for a route to be considered valid. This is where dynamic redirect URIs via the **serviceaccounts.openshift.io/oauth-redirectreference.** prefix come into play.

For example:

```
"serviceaccounts.openshift.io/oauth-redirectreference.first": "
{\"kind\":\"OAuthRedirectReference\",\"apiVersion\":\"v1\",\"reference\":
{\"kind\":\"Route\",\"name\":\"jenkins\"}}"
```

Since the value for this annotation contains serialized JSON data, it is easier to see in an expanded format:

```
{
  "kind": "OAuthRedirectReference",
  "apiVersion": "v1",
  "reference": {
    "kind": "Route",
    "name": "jenkins"
  }
}
```

Now you can see that an **OAuthRedirectReference** allows us to reference the route named **jenkins**. Thus, all Ingresses for that route will now be considered valid. The full specification for an **OAuthRedirectReference** is:

```
{
  "kind": "OAuthRedirectReference",
  "apiVersion": "v1",
  "reference": {
    "kind": ..., 1
    "name": ..., 2
    "group": ... 3
  }
}
```

1. **kind** refers to the type of the object being referenced. Currently, only **route** is supported.
2. **name** refers to the name of the object. The object must be in the same namespace as the service account.
3. **group** refers to the group of the object. Leave this blank, as the group for a route is the empty string.

Both annotation prefixes can be combined to override the data provided by the reference object. For example:

```
"serviceaccounts.openshift.io/oauth-redirecturi.first":  "custompath"
"serviceaccounts.openshift.io/oauth-redirectreference.first": "
{\"kind\":\"OAuthRedirectReference\",\"apiVersion\":\"v1\",\"reference\":
{\"kind\":\"Route\",\"name\":\"jenkins\"}}"
```

The **first** postfix is used to tie the annotations together. Assuming that the **jenkins** route had an Ingress of **https://example.com**, now **https://example.com/custompath** is considered valid, but **https://example.com** is not. The format for partially supplying override data is as follows:

Type	Syntax
Scheme	"https://"
Hostname	"//website.com"
Port	"//:8000"
Path	"examplepath"

NOTE

Specifying a host name override will replace the host name data from the referenced object, which is not likely to be desired behavior.

Any combination of the above syntax can be combined using the following format:

<scheme:>//<hostname><:port>/<path>

The same object can be referenced more than once for more flexibility:

```
"serviceaccounts.openshift.io/oauth-redirecturi.first":  "custompath"
"serviceaccounts.openshift.io/oauth-redirectreference.first": "
{\"kind\":\"OAuthRedirectReference\",\"apiVersion\":\"v1\",\"reference\":
{\"kind\":\"Route\",\"name\":\"jenkins\"}}"
"serviceaccounts.openshift.io/oauth-redirecturi.second":  "//:8000"
"serviceaccounts.openshift.io/oauth-redirectreference.second": "
{\"kind\":\"OAuthRedirectReference\",\"apiVersion\":\"v1\",\"reference\":
{\"kind\":\"Route\",\"name\":\"jenkins\"}}"
```

Assuming that the route named **jenkins** has an Ingress of **https://example.com**, then both **https://example.com:8000** and **https://example.com/custompath** are considered valid.

Static and dynamic annotations can be used at the same time to achieve the desired behavior:

```
"serviceaccounts.openshift.io/oauth-redirectreference.first": "
{\"kind\":\"OAuthRedirectReference\",\"apiVersion\":\"v1\",\"reference\":
{\"kind\":\"Route\",\"name\":\"jenkins\"}}"
"serviceaccounts.openshift.io/oauth-redirecturi.second": "https://other.com"
```

CHAPTER 10. SCOPING TOKENS

10.1. ABOUT SCOPING TOKENS

You can created scoped tokens to delegate some of your permissions to another user or service account. For example, a project administrator might want to delegate the power to create pods.

A scoped token is a token that identifies as a given user but is limited to certain actions by its scope. Only a user with the **cluster-admin** role can create scoped tokens.

Scopes are evaluated by converting the set of scopes for a token into a set of **PolicyRules**. Then, the request is matched against those rules. The request attributes must match at least one of the scope rules to be passed to the "normal" authorizer for further authorization checks.

10.1.1. User scopes

User scopes are focused on getting information about a given user. They are intent-based, so the rules are automatically created for you:

- **user:full** - Allows full read/write access to the API with all of the user's permissions.
- **user:info** - Allows read-only access to information about the user, such as name and groups.
- **user:check-access** - Allows access to **self-localsubjectaccessreviews** and **self-subjectaccessreviews**. These are the variables where you pass an empty user and groups in your request object.
- **user:list-projects** - Allows read-only access to list the projects the user has access to.

10.1.2. Role scope

The role scope allows you to have the same level of access as a given role filtered by namespace.

- **role:<cluster-role name>:<namespace or * for all>** - Limits the scope to the rules specified by the cluster-role, but only in the specified namespace .

NOTE

Caveat: This prevents escalating access. Even if the role allows access to resources like secrets, rolebindings, and roles, this scope will deny access to those resources. This helps prevent unexpected escalations. Many people do not think of a role like **edit** as being an escalating role, but with access to a secret it is.

- **role:<cluster-role name>:<namespace or * for all>:!** - This is similar to the example above, except that including the bang causes this scope to allow escalating access.

CHAPTER 11. USING BOUND SERVICE ACCOUNT TOKENS

You can use bound service account tokens, which improves the ability to integrate with cloud provider identity access management (IAM) services, such as AWS IAM.

11.1. ABOUT BOUND SERVICE ACCOUNT TOKENS

You can use bound service account tokens to limit the scope of permissions for a given service account token. These tokens are audience and time-bound. This facilitates the authentication of a service account to an IAM role and the generation of temporary credentials mounted to a pod. You can request bound service account tokens by using volume projection and the TokenRequest API.

IMPORTANT

Because the cluster installation process does not use them, bound service account tokens are configured post-installation.

11.2. CONFIGURING BOUND SERVICE ACCOUNT TOKENS USING VOLUME PROJECTION

You can configure pods to request bound service account tokens by using volume projection.

Prerequisites

- You have access to the cluster as a user with the **cluster-admin** role.
- You have created a service account. This procedure assumes that the service account is named **build-robot**.

Procedure

1. Optionally, set the service account issuer.
   This step is typically not required if the bound tokens are used only within the cluster.

WARNING

If you update the **serviceAccountIssuer** field and there are bound tokens already in use, all bound tokens with the previous issuer value will be invalidated. Unless the holder of a bound token has explicit support for a change in issuer, the holder will not request a new bound token until pods have been restarted.

If necessary, you can use the following command to manually restart all pods in the cluster. Be aware that running this command causes a service interruption, because it deletes every running pod in every namespace. These pods will automatically restart after they are deleted.

```
$ for I in $(oc get ns -o jsonpath='{range .items[*]} {.metadata.name}
{"\n"} {end}'); \
    do oc delete pods --all -n $I; \
    sleep 1; \
    done
```

a. Edit the **cluster Authentication** object:

```
$ oc edit authentications cluster
```

b. Set the **spec.serviceAccountIssuer** field to the desired service account issuer value:

```
spec:
  serviceAccountIssuer: https://test.default.svc 1
```

1 This value should be a URL from which the recipient of a bound token can source the public keys necessary to verify the signature of the token. The default is **https://kubernetes.default.svc**.

2. Configure a pod to use a bound service account token by using volume projection.

a. Create a file called **pod-projected-svc-token.yaml** with the following contents:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - image: nginx
    name: nginx
    volumeMounts:
    - mountPath: /var/run/secrets/tokens
      name: vault-token
  serviceAccountName: build-robot 1
  volumes:
```

```
- name: vault-token
  projected:
    sources:
    - serviceAccountToken:
        path: vault-token 2
        expirationSeconds: 7200 3
        audience: vault 4
```

1. A reference to an existing service account.
2. The path relative to the mount point of the file to project the token into.
3. Optionally set the expiration of the service account token, in seconds. The default is 3600 seconds (1 hour) and must be at least 600 seconds (10 minutes). The kubelet will start trying to rotate the token if the token is older than 80 percent of its time to live or if the token is older than 24 hours.
4. Optionally set the intended audience of the token. The recipient of a token should verify that the recipient identity matches the audience claim of the token, and should otherwise reject the token. The audience defaults to the identifier of the API server.

b. Create the pod:

```
$ oc create -f pod-projected-svc-token.yaml
```

The kubelet requests and stores the token on behalf of the pod, makes the token available to the pod at a configurable file path, and refreshes the token as it approaches expiration.

3. The application that uses the bound token must handle reloading the token when it rotates. The kubelet rotates the token if it is older than 80 percent of its time to live, or if the token is older than 24 hours.

CHAPTER 12. MANAGING SECURITY CONTEXT CONSTRAINTS

12.1. ABOUT SECURITY CONTEXT CONSTRAINTS

Similar to the way that RBAC resources control user access, administrators can use *security context constraints* (SCCs) to control permissions for pods. These permissions include actions that a *pod*, a collection of containers, can perform and what resources it can access. You can use SCCs to define a set of conditions that a pod must run with in order to be accepted into the system.

SCCs allow an administrator to control:

- Whether a pod can run privileged containers.
- The capabilities that a container can request.
- The use of host directories as volumes.
- The SELinux context of the container.
- The container user ID.
- The use of host namespaces and networking.
- The allocation of an **FSGroup** that owns the pod's volumes.
- The configuration of allowable supplemental groups.
- Whether a container requires the use of a read only root file system.
- The usage of volume types.
- The configuration of allowable **seccomp** profiles.

The cluster contains eight default SCCs:

- **anyuid**
- **hostaccess**
- **hostmount-anyuid**
- **hostnetwork**

WARNING

If additional workloads are run on master hosts, use caution when providing access to **hostnetwork**. A workload that runs **hostnetwork** on a master host is effectively root on the cluster and must be trusted accordingly.

- **node-exporter**

- **nonroot**
- **privileged**
- **restricted**

IMPORTANT

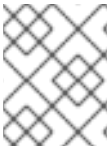
Do not modify the default SCCs. Customizing the default SCCs can lead to issues when some of the platform pods deploy or OpenShift Container Platform is upgraded. During upgrades between some versions of OpenShift Container Platform, the values of the default SCCs are reset to the default values, which discards all customizations to those SCCs. Instead, create new SCCs.

The **privileged** SCC allows:

- Users to run privileged pods
- Pods to mount host directories as volumes
- Pods to run as any user
- Pods to run with any MCS label
- Pods to use the host's IPC namespace
- Pods to use the host's PID namespace
- Pods to use any FSGroup
- Pods to use any supplemental group
- Pods to use any seccomp profiles
- Pods to request any capabilities

The **restricted** SCC:

- Ensures that pods cannot run as privileged.
- Ensures that pods cannot mount host directory volumes.
- Requires that a pod run as a user in a pre-allocated range of UIDs.
- Requires that a pod run with a pre-allocated MCS label.
- Allows pods to use any FSGroup.
- Allows pods to use any supplemental group.



NOTE

For more information about each SCC, see the **kubernetes.io/description** annotation available on the SCC.

SCCs are composed of settings and strategies that control the security features a pod has access to. These settings fall into three categories:

Category	Description
Controlled by a boolean	Fields of this type default to the most restrictive value. For example, **AllowPrivilegedContainer** is always set to **false** if unspecified.
Controlled by an allowable set	Fields of this type are checked against the set to ensure their value is allowed.
Controlled by a strategy	Items that have a strategy to generate a value provide: • A mechanism to generate the value, and • A mechanism to ensure that a specified value falls into the set of allowable values.

CRI-O has the following default list of capabilities that are allowed for each container of a pod:

- **CHOWN**
- **DAC_OVERRIDE**
- **FSETID**
- **FOWNER**
- **SETGID**
- **SETUID**
- **SETPCAP**
- **NET_BIND_SERVICE**
- **KILL**

The containers use the capabilities from this default list, but pod manifest authors can alter it by requesting additional capabilities or removing some of the default behaviors. Use the **allowedCapabilities**, **defaultAddCapabilities**, and **requiredDropCapabilities** parameters to control such requests from the pods and to dictate which capabilities can be requested, which ones must be added to each container, and which ones must be forbidden.

12.1.1. SCC Strategies

RunAsUser

1. **MustRunAs** - Requires a **runAsUser** to be configured. Uses the configured **runAsUser** as the default. Validates against the configured **runAsUser**.

2. **MustRunAsRange** - Requires minimum and maximum values to be defined if not using pre-allocated values. Uses the minimum as the default. Validates against the entire allowable range.

3. **MustRunAsNonRoot** - Requires that the pod be submitted with a non-zero **runAsUser** or have the **USER** directive defined in the image. No default provided.

4. **RunAsAny** - No default provided. Allows any **runAsUser** to be specified.

SELinuxContext

1. **MustRunAs** - Requires **seLinuxOptions** to be configured if not using pre-allocated values. Uses **seLinuxOptions** as the default. Validates against **seLinuxOptions**.

2. **RunAsAny** - No default provided. Allows any **seLinuxOptions** to be specified.

SupplementalGroups

1. **MustRunAs** - Requires at least one range to be specified if not using pre-allocated values. Uses the minimum value of the first range as the default. Validates against all ranges.

2. **RunAsAny** - No default provided. Allows any **supplementalGroups** to be specified.

FSGroup

1. **MustRunAs** - Requires at least one range to be specified if not using pre-allocated values. Uses the minimum value of the first range as the default. Validates against the first ID in the first range.

2. **RunAsAny** - No default provided. Allows any **fsGroup** ID to be specified.

12.1.2. Controlling volumes

The usage of specific volume types can be controlled by setting the **volumes** field of the SCC. The allowable values of this field correspond to the volume sources that are defined when creating a volume:

- **azureFile**
- **azureDisk**
- **flocker**
- **flexVolume**
- **hostPath**
- **emptyDir**
- **gcePersistentDisk**
- **awsElasticBlockStore**
- **gitRepo**
- **secret**
- **nfs**
- **iscsi**

- glusterfs
- persistentVolumeClaim
- rbd
- cinder
- cephFS
- downwardAPI
- fc
- configMap
- vsphereVolume
- quobyte
- photonPersistentDisk
- projected
- portworxVolume
- scaleIO
- storageos
- * (a special value to allow the use of all volume types)
- **none** (a special value to disallow the use of all volumes types. Exist only for backwards compatibility)

The recommended minimum set of allowed volumes for new SCCs are **configMap**, **downwardAPI**, **emptyDir**, **persistentVolumeClaim**, **secret**, and **projected**.

NOTE

The list of allowable volume types is not exhaustive because new types are added with each release of OpenShift Container Platform.

NOTE

For backwards compatibility, the usage of **allowHostDirVolumePlugin** overrides settings in the **volumes** field. For example, if **allowHostDirVolumePlugin** is set to false but allowed in the **volumes** field, then the **hostPath** value will be removed from **volumes**.

12.1.3. Admission

Admission control with SCCs allows for control over the creation of resources based on the capabilities granted to a user.

In terms of the SCCs, this means that an admission controller can inspect the user information made available in the context to retrieve an appropriate set of SCCs. Doing so ensures the pod is authorized

to make requests about its operating environment or to generate a set of constraints to apply to the pod.

The set of SCCs that admission uses to authorize a pod are determined by the user identity and groups that the user belongs to. Additionally, if the pod specifies a service account, the set of allowable SCCs includes any constraints accessible to the service account.

Admission uses the following approach to create the final security context for the pod:

1. Retrieve all SCCs available for use.
2. Generate field values for security context settings that were not specified on the request.
3. Validate the final settings against the available constraints.

If a matching set of constraints is found, then the pod is accepted. If the request cannot be matched to an SCC, the pod is rejected.

A pod must validate every field against the SCC. The following are examples for just two of the fields that must be validated:

NOTE

These examples are in the context of a strategy using the preallocated values.

A FSGroup SCC strategy of MustRunAs

If the pod defines a **fsGroup** ID, then that ID must equal the default **fsGroup** ID. Otherwise, the pod is not validated by that SCC and the next SCC is evaluated.

If the **SecurityContextConstraints.fsGroup** field has value **RunAsAny** and the pod specification omits the **Pod.spec.securityContext.fsGroup**, then this field is considered valid. Note that it is possible that during validation, other SCC settings will reject other pod fields and thus cause the pod to fail.

A SupplementalGroups SCC strategy of MustRunAs

If the pod specification defines one or more **supplementalGroups** IDs, then the pod's IDs must equal one of the IDs in the namespace's **openshift.io/sa.scc.supplemental-groups** annotation. Otherwise, the pod is not validated by that SCC and the next SCC is evaluated.

If the **SecurityContextConstraints.supplementalGroups** field has value **RunAsAny** and the pod specification omits the **Pod.spec.securityContext.supplementalGroups**, then this field is considered valid. Note that it is possible that during validation, other SCC settings will reject other pod fields and thus cause the pod to fail.

12.1.4. SCC prioritization

SCCs have a priority field that affects the ordering when attempting to validate a request by the admission controller. A higher priority SCC is moved to the front of the set when sorting. When the complete set of available SCCs are determined they are ordered by:

1. Highest priority first, nil is considered a 0 priority
2. If priorities are equal, the SCCs will be sorted from most restrictive to least restrictive
3. If both priorities and restrictions are equal the SCCs will be sorted by name

By default, the **anyuid** SCC granted to cluster administrators is given priority in their SCC set. This allows cluster administrators to run pods as any user by without specifying a **RunAsUser** on the pod's **SecurityContext**. The administrator may still specify a **RunAsUser** if they wish.

12.2. ABOUT PRE-ALLOCATED SECURITY CONTEXT CONSTRAINTS VALUES

The admission controller is aware of certain conditions in the security context constraints (SCCs) that trigger it to look up pre-allocated values from a namespace and populate the SCC before processing the pod. Each SCC strategy is evaluated independently of other strategies, with the pre-allocated values, where allowed, for each policy aggregated with pod specification values to make the final values for the various IDs defined in the running pod.

The following SCCs cause the admission controller to look for pre-allocated values when no ranges are defined in the pod specification:

1. A **RunAsUser** strategy of **MustRunAsRange** with no minimum or maximum set. Admission looks for the **openshift.io/sa.scc.uid-range** annotation to populate range fields.

2. An **SELinuxContext** strategy of **MustRunAs** with no level set. Admission looks for the **openshift.io/sa.scc.mcs** annotation to populate the level.

3. A **FSGroup** strategy of **MustRunAs**. Admission looks for the **openshift.io/sa.scc.supplemental-groups** annotation.

4. A **SupplementalGroups** strategy of **MustRunAs**. Admission looks for the **openshift.io/sa.scc.supplemental-groups** annotation.

During the generation phase, the security context provider uses default values for any parameter values that are not specifically set in the pod. Default values are based on the selected strategy:

1. **RunAsAny** and **MustRunAsNonRoot** strategies do not provide default values. If the pod needs a parameter value, such as a group ID, you must define the value in the pod specification.

2. **MustRunAs** (single value) strategies provide a default value that is always used. For example, for group IDs, even if the pod specification defines its own ID value, the namespace's default parameter value also appears in the pod's groups.

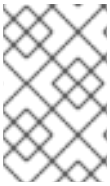
3. **MustRunAsRange** and **MustRunAs** (range-based) strategies provide the minimum value of the range. As with a single value **MustRunAs** strategy, the namespace's default parameter value appears in the running pod. If a range-based strategy is configurable with multiple ranges, it provides the minimum value of the first configured range.

NOTE

FSGroup and **SupplementalGroups** strategies fall back to the **openshift.io/sa.scc.uid-range** annotation if the **openshift.io/sa.scc.supplemental-groups** annotation does not exist on the namespace. If neither exists, the SCC is not created.

NOTE

By default, the annotation-based **FSGroup** strategy configures itself with a single range based on the minimum value for the annotation. For example, if your annotation reads **1/3**, the **FSGroup** strategy configures itself with a minimum and maximum value of **1**. If you want to allow more groups to be accepted for the **FSGroup** field, you can configure a custom SCC that does not use the annotation.



NOTE

The **openshift.io/sa.scc.supplemental-groups** annotation accepts a comma-delimited list of blocks in the format of **<start>/<length** or **<start>-<end>**. The **openshift.io/sa.scc.uid-range** annotation accepts only a single block.

12.3. EXAMPLE SECURITY CONTEXT CONSTRAINTS

The following examples show the security context constraints (SCC) format and annotations:

Annotated priviledged SCC

```
allowHostDirVolumePlugin: true
allowHostIPC: true
allowHostNetwork: true
allowHostPID: true
allowHostPorts: true
allowPrivilegedContainer: true
allowedCapabilities: 1
- '*'
apiVersion: security.openshift.io/v1
defaultAddCapabilities: [] 2
fsGroup: 3
  type: RunAsAny
groups: 4
- system:cluster-admins
- system:nodes
kind: SecurityContextConstraints
metadata:
  annotations:
    kubernetes.io/description: 'privileged allows access to all privileged and host
      features and the ability to run as any user, any group, any fsGroup, and with
      any SELinux context.  WARNING: this is the most relaxed SCC and should be used
      only for cluster administration. Grant with caution.'
  creationTimestamp: null
  name: privileged
priority: null
readOnlyRootFilesystem: false
requiredDropCapabilities: [] 5
runAsUser: 6
  type: RunAsAny
seLinuxContext: 7
  type: RunAsAny
seccompProfiles:
- '*'
supplementalGroups: 8
```

```
  type: RunAsAny
users: 9
- system:serviceaccount:default:registry
- system:serviceaccount:default:router
- system:serviceaccount:openshift-infra:build-controller
volumes:
- '*'
```

1. A list of capabilities that a pod can request. An empty list means that none of capabilities can be requested while the special symbol ***** allows any capabilities.
2. A list of additional capabilities that are added to any pod.
3. The **FSGroup** strategy, which dictates the allowable values for the security context.
4. The groups that can access this SCC.
5. A list of capabilities that are be dropped from a pod.
6. The **runAsUser** strategy type, which dictates the allowable values for the Security Context.
7. The **seLinuxContext** strategy type, which dictates the allowable values for the Security Context.
8. The **supplementalGroups** strategy, which dictates the allowable supplemental groups for the Security Context.
9. The users who can access this SCC.

The **users** and **groups** fields on the SCC control which users can access the SCC. By default, cluster administrators, nodes, and the build controller are granted access to the privileged SCC. All authenticated users are granted access to the restricted SCC.

Without explicit runAsUser setting

```
apiVersion: v1
kind: Pod
metadata:
  name: security-context-demo
spec:
  securityContext: 1
  containers:
  - name: sec-ctx-demo
    image: gcr.io/google-samples/node-hello:1.0
```

1. When a container or pod does not request a user ID under which it should be run, the effective UID depends on the SCC that emits this pod. Because restricted SCC is granted to all authenticated users by default, it will be available to all users and service accounts and used in most cases. The restricted SCC uses **MustRunAsRange** strategy for constraining and defaulting the possible values of the **securityContext.runAsUser** field. The admission plug-in will look for the **openshift.io/sa.scc.uid-range** annotation on the current project to populate range fields, as it does not provide this range. In the end, a container will have **runAsUser** equal to the first value of the range that is hard to predict because every project has different ranges.

With explicit runAsUser setting

```
apiVersion: v1
kind: Pod
metadata:
  name: security-context-demo
spec:
  securityContext:
    runAsUser: 1000 (1)
  containers:
    - name: sec-ctx-demo
      image: gcr.io/google-samples/node-hello:1.0
```

(1) A container or pod that requests a specific user ID will be accepted by OpenShift Container Platform only when a service account or a user is granted access to a SCC that allows such a user ID. The SCC can allow arbitrary IDs, an ID that falls into a range, or the exact user ID specific to the request.

This configuration is valid for SELinux, fsGroup, and Supplemental Groups.

12.4. CREATING SECURITY CONTEXT CONSTRAINTS

You can create security context constraints (SCCs) by using the OpenShift CLI (**oc**).

Prerequisites

- Install the OpenShift CLI (**oc**).
- Log in to the cluster as a user with the **cluster-admin** role.

Procedure

1. Define the SCC in a YAML file named **scc_admin.yaml**:

   SecurityContextConstraints object definition

   ```
   kind: SecurityContextConstraints
   apiVersion: security.openshift.io/v1
   metadata:
     name: scc-admin
   allowPrivilegedContainer: true
   runAsUser:
     type: RunAsAny
   seLinuxContext:
     type: RunAsAny
   fsGroup:
     type: RunAsAny
   supplementalGroups:
     type: RunAsAny
   users:
   - my-admin-user
   groups:
   - my-admin-group
   ```

   Optionally, you can specify drop capabilities for an SCC by setting the

requiredDropCapabilities field with the desired values. Any specified capabilities are dropped from the container. For example, to create an SCC with the **KILL**, **MKNOD**, and **SYS_CHROOT** required drop capabilities, add the following to the SCC object:

```
requiredDropCapabilities:
- KILL
- MKNOD
- SYS_CHROOT
```

CRI-O supports the same list of capability values that are found in the Docker documentation.

2. Create the SCC by passing in the file:

```
$ oc create -f scc_admin.yaml
```

Example output

```
securitycontextconstraints "scc-admin" created
```

Verification

- Verify that the SCC was created:

```
$ oc get scc scc-admin
```

Example output

```
NAME      PRIV    CAPS    SELINUX    RUNASUSER    FSGROUP    SUPGROUP
PRIORITY    READONLYROOTFS    VOLUMES
scc-admin    true    []    RunAsAny    RunAsAny    RunAsAny    RunAsAny    <none>    false
[awsElasticBlockStore azureDisk azureFile cephFS cinder configMap downwardAPI
emptyDir fc flexVolume flocker gcePersistentDisk gitRepo glusterfs iscsi nfs
persistentVolumeClaim photonPersistentDisk quobyte rbd secret vsphere]
```

12.5. ROLE-BASED ACCESS TO SECURITY CONTEXT CONSTRAINTS

You can specify SCCs as resources that are handled by RBAC. This allows you to scope access to your SCCs to a certain project or to the entire cluster. Assigning users, groups, or service accounts directly to an SCC retains cluster-wide scope.

NOTE

You cannot assign a SCC to pods created in one of the default namespaces: **default**, **kube-system**, **kube-public**, **openshift-node**, **openshift-infra**, **openshift**. These namespaces should not be used for running pods or services.

To include access to SCCs for your role, specify the **scc** resource when creating a role.

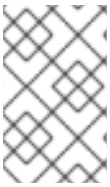
```
$ oc create role <role-name> --verb=use --resource=scc --resource-name=<scc-name> -n
<namespace>
```

This results in the following role definition:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
...
  name: role-name 1
  namespace: namespace 2
...
rules:
- apiGroups:
  - security.openshift.io 3
  resourceNames:
  - scc-name 4
  resources:
  - securitycontextconstraints 5
  verbs: 6
  - use
```

1. The role's name.
2. Namespace of the defined role. Defaults to **default** if not specified.
3. The API group that includes the **SecurityContextConstraints** resource. Automatically defined when **scc** is specified as a resource.
4. An example name for an SCC you want to have access.
5. Name of the resource group that allows users to specify SCC names in the **resourceNames** field.
6. A list of verbs to apply to the role.

A local or cluster role with such a rule allows the subjects that are bound to it with a role binding or a cluster role binding to use the user-defined SCC called **scc-name**.



NOTE

Because RBAC is designed to prevent escalation, even project administrators are unable to grant access to an SCC. By default, they are not allowed to use the verb **use** on SCC resources, including the **restricted** SCC.

12.6. SECURITY CONTEXT CONSTRAINTS REFERENCE COMMANDS

You can manage SCCs in your instance as normal API objects using the CLI.

NOTE

You must have **cluster-admin** privileges to manage SCCs.

IMPORTANT

Do not modify the default SCCs. Customizing the default SCCs can lead to issues when some of the platform pods deploy or OpenShift Container Platform is upgraded. During upgrades between some versions of OpenShift Container Platform, the values of the default SCCs are reset to the default values, which discards all customizations to those SCCs.

12.6.1. Listing SCCs

To get a current list of SCCs:

```
$ oc get scc
```

Example output

```
NAME              PRIV    CAPS    SELINUX     RUNASUSER        FSGROUP     SUPGROUP
PRIORITY    READONLYROOTFS   VOLUMES
anyuid            false   []      MustRunAs   RunAsAny         RunAsAny    RunAsAny    10
false       [configMap downwardAPI emptyDir persistentVolumeClaim projected secret]
hostaccess        false   []      MustRunAs   MustRunAsRange   MustRunAs   RunAsAny    <none>
false       [configMap downwardAPI emptyDir hostPath persistentVolumeClaim projected secret]
hostmount-anyuid  false   []      MustRunAs   RunAsAny         RunAsAny    RunAsAny    <none>
false       [configMap downwardAPI emptyDir hostPath nfs persistentVolumeClaim projected
secret]
hostnetwork       false   []      MustRunAs   MustRunAsRange   MustRunAs   MustRunAs   <none>
false       [configMap downwardAPI emptyDir persistentVolumeClaim projected secret]
node-exporter     false   []      RunAsAny    RunAsAny         RunAsAny    RunAsAny    <none>    false
[*]
nonroot           false   []      MustRunAs   MustRunAsNonRoot RunAsAny    RunAsAny    <none>
false       [configMap downwardAPI emptyDir persistentVolumeClaim projected secret]
privileged        true    [*]     RunAsAny    RunAsAny         RunAsAny    RunAsAny    <none>    false
[*]
restricted        false   []      MustRunAs   MustRunAsRange   MustRunAs   RunAsAny    <none>
false       [configMap downwardAPI emptyDir persistentVolumeClaim projected secret]
```

12.6.2. Examining an SCC

You can view information about a particular SCC, including which users, service accounts, and groups the SCC is applied to.

For example, to examine the **restricted** SCC:

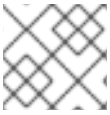
```
$ oc describe scc restricted
```

Example output

```
Name:     restricted
Priority:   <none>
Access:
  Users:    <none> (1)
  Groups:   system:authenticated (2)
Settings:
```

```
  Allow Privileged:   false
  Default Add Capabilities:  <none>
  Required Drop Capabilities:  KILL,MKNOD,SYS_CHROOT,SETUID,SETGID
  Allowed Capabilities:   <none>
  Allowed Seccomp Profiles:  <none>
  Allowed Volume Types:
configMap,downwardAPI,emptyDir,persistentVolumeClaim,projected,secret
  Allow Host Network:   false
  Allow Host Ports:   false
  Allow Host PID:   false
  Allow Host IPC:   false
  Read Only Root Filesystem:  false
  Run As User Strategy: MustRunAsRange
    UID:    <none>
    UID Range Min:   <none>
    UID Range Max:   <none>
  SELinux Context Strategy: MustRunAs
    User:    <none>
    Role:    <none>
    Type:    <none>
    Level:    <none>
  FSGroup Strategy: MustRunAs
    Ranges:    <none>
  Supplemental Groups Strategy: RunAsAny
    Ranges:    <none>
```

1. Lists which users and service accounts the SCC is applied to.
2. Lists which groups the SCC is applied to.



NOTE

To preserve customized SCCs during upgrades, do not edit settings on the default SCCs.

12.6.3. Deleting an SCC

To delete an SCC:

```
$ oc delete scc <scc_name>
```

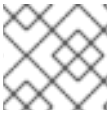
NOTE

If you delete a default SCC, it will regenerate when you restart the cluster.

12.6.4. Updating an SCC

To update an existing SCC:

```
$ oc edit scc <scc_name>
```



NOTE

To preserve customized SCCs during upgrades, do not edit settings on the default SCCs.

CHAPTER 13. IMPERSONATING THE SYSTEM:ADMIN USER

13.1. API IMPERSONATION

You can configure a request to the OpenShift Container Platform API to act as though it originated from another user. For more information, see User impersonation in the Kubernetes documentation.

13.2. IMPERSONATING THE SYSTEM:ADMIN USER

You can grant a user permission to impersonate **system:admin**, which grants them cluster administrator permissions.

Procedure

- To grant a user permission to impersonate **system:admin**, run the following command:

```
$ oc create clusterrolebinding <any_valid_name> --clusterrole=sudoer --user=<username>
```

13.3. IMPERSONATING THE SYSTEM:ADMIN GROUP

When a **system:admin** user is granted cluster administration permissions through a group, you must include the **--as=<user> --as-group=<group1> --as-group=<group2>** parameters in the command to impersonate the associated groups.

Procedure

- To grant a user permission to impersonate a **system:admin** by impersonating the associated cluster administration groups, run the following command:

```
$ oc create clusterrolebinding <any_valid_name> --clusterrole=sudoer --as=<user> \
--as-group=<group1> --as-group=<group2>
```

CHAPTER 14. SYNCING LDAP GROUPS

As an administrator, you can use groups to manage users, change their permissions, and enhance collaboration. Your organization may have already created user groups and stored them in an LDAP server. OpenShift Container Platform can sync those LDAP records with internal OpenShift Container Platform records, enabling you to manage your groups in one place. OpenShift Container Platform currently supports group sync with LDAP servers using three common schemas for defining group membership: RFC 2307, Active Directory, and augmented Active Directory.

For more information on configuring LDAP, see Configuring an LDAP identity provider.

NOTE

You must have **cluster-admin** privileges to sync groups.

14.1. ABOUT CONFIGURING LDAP SYNC

Before you can run LDAP sync, you need a sync configuration file. This file contains the following LDAP client configuration details:

- Configuration for connecting to your LDAP server.
- Sync configuration options that are dependent on the schema used in your LDAP server.
- An administrator-defined list of name mappings that maps OpenShift Container Platform group names to groups in your LDAP server.

The format of the configuration file depends upon the schema you are using: RFC 2307, Active Directory, or augmented Active Directory.

LDAP client configuration

The LDAP client configuration section of the configuration defines the connections to your LDAP server.

The LDAP client configuration section of the configuration defines the connections to your LDAP server.

LDAP client configuration

```
url: ldap://10.0.0.0:389 (1)
bindDN: cn=admin,dc=example,dc=com (2)
bindPassword: password (3)
insecure: false (4)
ca: my-ldap-ca-bundle.crt (5)
```

(1) The connection protocol, IP address of the LDAP server hosting your database, and the port to connect to, formatted as **scheme://host:port**.

(2) Optional distinguished name (DN) to use as the Bind DN. OpenShift Container Platform uses this if elevated privilege is required to retrieve entries for the sync operation.

(3) Optional password to use to bind. OpenShift Container Platform uses this if elevated privilege is necessary to retrieve entries for the sync operation. This value may also be provided in an environment variable, external file, or encrypted file.

4 When **false**, secure LDAP (**ldaps://**) URLs connect using TLS, and insecure LDAP (**ldap://**) URLs are upgraded to TLS. When **true**, no TLS connection is made to the server and you cannot use

5 The certificate bundle to use for validating server certificates for the configured URL. If empty, OpenShift Container Platform uses system-trusted roots. This only applies if **insecure** is set to **false**.

LDAP query definition

Sync configurations consist of LDAP query definitions for the entries that are required for synchronization. The specific definition of an LDAP query depends on the schema used to store membership information in the LDAP server.

LDAP query definition

```
baseDN: ou=users,dc=example,dc=com 1
scope: sub 2
derefAliases: never 3
timeout: 0 4
filter: (objectClass=person) 5
pageSize: 0 6
```

1 The distinguished name (DN) of the branch of the directory where all searches will start from. It is required that you specify the top of your directory tree, but you can also specify a subtree in the directory.

2 The scope of the search. Valid values are **base**, **one**, or **sub**. If this is left undefined, then a scope of **sub** is assumed. Descriptions of the scope options can be found in the table below.

3 The behavior of the search with respect to aliases in the LDAP tree. Valid values are **never**, **search**, **base**, or **always**. If this is left undefined, then the default is to **always** dereference aliases. Descriptions of the dereferencing behaviors can be found in the table below.

4 The time limit allowed for the search by the client, in seconds. A value of **0** imposes no client-side limit.

5 A valid LDAP search filter. If this is left undefined, then the default is **(objectClass=*)**.

6 The optional maximum size of response pages from the server, measured in LDAP entries. If set to **0**, no size restrictions will be made on pages of responses. Setting paging sizes is necessary when queries return more entries than the client or server allow by default.

Table 14.1. LDAP search scope options

LDAP search scope	Description
base	Only consider the object specified by the base DN given for the query.
one	Consider all of the objects on the same level in the tree as the base DN for the query.
sub	Consider the entire subtree rooted at the base DN given for the query.

Table 14.2. LDAP dereferencing behaviors

Dereferencing behavior	Description
never	Never dereference any aliases found in the LDAP tree.
search	Only dereference aliases found while searching.
base	Only dereference aliases while finding the base object.
always	Always dereference all aliases found in the LDAP tree.

User-defined name mapping

A user-defined name mapping explicitly maps the names of OpenShift Container Platform groups to unique identifiers that find groups on your LDAP server. The mapping uses normal YAML syntax. A user-defined mapping can contain an entry for every group in your LDAP server or only a subset of those groups. If there are groups on the LDAP server that do not have a user-defined name mapping, the default behavior during sync is to use the attribute specified as the OpenShift Container Platform group's name.

User-defined name mapping

```
groupUIDNameMapping:
  "cn=group1,ou=groups,dc=example,dc=com": firstgroup
  "cn=group2,ou=groups,dc=example,dc=com": secondgroup
  "cn=group3,ou=groups,dc=example,dc=com": thirdgroup
```

14.1.1. About the RFC 2307 configuration file

The RFC 2307 schema requires you to provide an LDAP query definition for both user and group entries, as well as the attributes with which to represent them in the internal OpenShift Container Platform records.

For clarity, the group you create in OpenShift Container Platform should use attributes other than the distinguished name whenever possible for user- or administrator-facing fields. For example, identify the users of an OpenShift Container Platform group by their e-mail, and use the name of the group as the common name. The following configuration file creates these relationships:

NOTE

If using user-defined name mappings, your configuration file will differ.

LDAP sync configuration that uses RFC 2307 schema: rfc2307_config.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
url: ldap://LDAP_SERVICE_IP:389 (1)
insecure: false (2)
rfc2307:
    groupsQuery:
```

```
    baseDN: "ou=groups,dc=example,dc=com"
    scope: sub
    derefAliases: never
    pageSize: 0
groupUIDAttribute: dn 3
groupNameAttributes: [ cn ] 4
groupMembershipAttributes: [ member ] 5
usersQuery:
    baseDN: "ou=users,dc=example,dc=com"
    scope: sub
    derefAliases: never
    pageSize: 0
userUIDAttribute: dn 6
userNameAttributes: [ mail ] 7
tolerateMemberNotFoundErrors: false
tolerateMemberOutOfScopeErrors: false
```

1. The IP address and host of the LDAP server where this group's record is stored.
2. When **false**, secure LDAP (**ldaps://**) URLs connect using TLS, and insecure LDAP (**ldap://**) URLs are upgraded to TLS. When **true**, no TLS connection is made to the server and you cannot use **ldaps://** URL schemes.
3. The attribute that uniquely identifies a group on the LDAP server. You cannot specify **groupsQuery** filters when using DN for **groupUIDAttribute**. For fine-grained filtering, use the whitelist / blacklist method.
4. The attribute to use as the name of the group.
5. The attribute on the group that stores the membership information.
6. The attribute that uniquely identifies a user on the LDAP server. You cannot specify **usersQuery** filters when using DN for userUIDAttribute. For fine-grained filtering, use the whitelist / blacklist method.
7. The attribute to use as the name of the user in the OpenShift Container Platform group record.

14.1.2. About the Active Directory configuration file

The Active Directory schema requires you to provide an LDAP query definition for user entries, as well as the attributes to represent them with in the internal OpenShift Container Platform group records.

For clarity, the group you create in OpenShift Container Platform should use attributes other than the distinguished name whenever possible for user- or administrator-facing fields. For example, identify the users of an OpenShift Container Platform group by their e-mail, but define the name of the group by the name of the group on the LDAP server. The following configuration file creates these relationships:

LDAP sync configuration that uses Active Directory schema: active_directory_config.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
url: ldap://LDAP_SERVICE_IP:389
activeDirectory:
    usersQuery:
```

```
    baseDN: "ou=users,dc=example,dc=com"
    scope: sub
    derefAliases: never
    filter: (objectclass=person)
    pageSize: 0
  userNameAttributes: [ mail ] (1)
  groupMembershipAttributes: [ memberOf ] (2)
```

1. The attribute to use as the name of the user in the OpenShift Container Platform group record.
2. The attribute on the user that stores the membership information.

14.1.3. About the augmented Active Directory configuration file

The augmented Active Directory schema requires you to provide an LDAP query definition for both user entries and group entries, as well as the attributes with which to represent them in the internal OpenShift Container Platform group records.

For clarity, the group you create in OpenShift Container Platform should use attributes other than the distinguished name whenever possible for user- or administrator-facing fields. For example, identify the users of an OpenShift Container Platform group by their e-mail, and use the name of the group as the common name. The following configuration file creates these relationships.

LDAP sync configuration that uses augmented Active Directory schema: augmented_active_directory_config.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
url: ldap://LDAP_SERVICE_IP:389
augmentedActiveDirectory:
  groupsQuery:
    baseDN: "ou=groups,dc=example,dc=com"
    scope: sub
    derefAliases: never
    pageSize: 0
  groupUIDAttribute: dn (1)
  groupNameAttributes: [ cn ] (2)
  usersQuery:
    baseDN: "ou=users,dc=example,dc=com"
    scope: sub
    derefAliases: never
    filter: (objectclass=person)
    pageSize: 0
  userNameAttributes: [ mail ] (3)
  groupMembershipAttributes: [ memberOf ] (4)
```

1. The attribute that uniquely identifies a group on the LDAP server. You cannot specify **groupsQuery** filters when using DN for groupUIDAttribute. For fine-grained filtering, use the whitelist / blacklist method.
2. The attribute to use as the name of the group.
3. The attribute to use as the name of the user in the OpenShift Container Platform group record.

4 The attribute on the user that stores the membership information.

14.2. RUNNING LDAP SYNC

Once you have created a sync configuration file, you can begin to sync. OpenShift Container Platform allows administrators to perform a number of different sync types with the same server.

14.2.1. Syncing the LDAP server with OpenShift Container Platform

You can sync all groups from the LDAP server with OpenShift Container Platform.

Prerequisites

- Create a sync configuration file.

Procedure

- To sync all groups from the LDAP server with OpenShift Container Platform:

```
$ oc adm groups sync --sync-config=config.yaml --confirm
```

NOTE

By default, all group synchronization operations are dry-run, so you must set the **--confirm** flag on the **oc adm groups sync** command in order to make changes to OpenShift Container Platform group records.

14.2.2. Syncing OpenShift Container Platform groups with the LDAP server

You can sync all groups already in OpenShift Container Platform that correspond to groups in the LDAP server specified in the configuration file.

Prerequisites

- Create a sync configuration file.

Procedure

- To sync OpenShift Container Platform groups with the LDAP server:

```
$ oc adm groups sync --type=openshift --sync-config=config.yaml --confirm
```

NOTE

By default, all group synchronization operations are dry-run, so you must set the **--confirm** flag on the **oc adm groups sync** command in order to make changes to OpenShift Container Platform group records.

14.2.3. Syncing subgroups from the LDAP server with OpenShift Container Platform

You can sync a subset of LDAP groups with OpenShift Container Platform using whitelist files, blacklist files, or both.

NOTE

You can use any combination of blacklist files, whitelist files, or whitelist literals. Whitelist and blacklist files must contain one unique group identifier per line, and you can include whitelist literals directly in the command itself. These guidelines apply to groups found on LDAP servers as well as groups already present in OpenShift Container Platform.

Prerequisites

- Create a sync configuration file.

Procedure

- To sync a subset of LDAP groups with OpenShift Container Platform, use any the following commands:

```
$ oc adm groups sync --whitelist=<whitelist_file> \
                --sync-config=config.yaml      \
                --confirm
```

```
$ oc adm groups sync --blacklist=<blacklist_file> \
                --sync-config=config.yaml      \
                --confirm
```

```
$ oc adm groups sync <group_unique_identifier>    \
                --sync-config=config.yaml      \
                --confirm
```

```
$ oc adm groups sync <group_unique_identifier>  \
                --whitelist=<whitelist_file> \
                --blacklist=<blacklist_file> \
                --sync-config=config.yaml    \
                --confirm
```

```
$ oc adm groups sync --type=openshift           \
                --whitelist=<whitelist_file> \
                --sync-config=config.yaml    \
                --confirm
```

NOTE

By default, all group synchronization operations are dry-run, so you must set the **--confirm** flag on the **oc adm groups sync** command in order to make changes to OpenShift Container Platform group records.

14.3. RUNNING A GROUP PRUNING JOB

An administrator can also choose to remove groups from OpenShift Container Platform records if the records on the LDAP server that created them are no longer present. The prune job will accept the same sync configuration file and whitelists or blacklists as used for the sync job.

For example:

```
$ oc adm prune groups --sync-config=/path/to/ldap-sync-config.yaml --confirm
```

```
$ oc adm prune groups --whitelist=/path/to/whitelist.txt --sync-config=/path/to/ldap-sync-config.yaml --confirm
```

```
$ oc adm prune groups --blacklist=/path/to/blacklist.txt --sync-config=/path/to/ldap-sync-config.yaml --confirm
```

14.4. LDAP GROUP SYNC EXAMPLES

This section contains examples for the RFC 2307, Active Directory, and augmented Active Directory schemas.

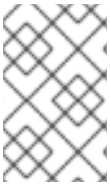
NOTE

These examples assume that all users are direct members of their respective groups. Specifically, no groups have other groups as members. See the Nested Membership Sync Example for information on how to sync nested groups.

14.4.1. Syncing groups using the RFC 2307 schema

For the RFC 2307 schema, the following examples synchronize a group named **admins** that has two members: **Jane** and **Jim**. The examples explain:

- How the group and users are added to the LDAP server.
- What the resulting group record in OpenShift Container Platform will be after synchronization.



NOTE

These examples assume that all users are direct members of their respective groups. Specifically, no groups have other groups as members. See the Nested Membership Sync Example for information on how to sync nested groups.

In the RFC 2307 schema, both users (Jane and Jim) and groups exist on the LDAP server as first-class entries, and group membership is stored in attributes on the group. The following snippet of **ldif** defines the users and group for this schema:

LDAP entries that use RFC 2307 schema: rfc2307.ldif

```
dn: ou=users,dc=example,dc=com
objectClass: organizationalUnit
ou: users
dn: cn=Jane,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
```

```
objectClass: inetOrgPerson
cn: Jane
sn: Smith
displayName: Jane Smith
mail: jane.smith@example.com
dn: cn=Jim,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
cn: Jim
sn: Adams
displayName: Jim Adams
mail: jim.adams@example.com
dn: ou=groups,dc=example,dc=com
objectClass: organizationalUnit
ou: groups
dn: cn=admins,ou=groups,dc=example,dc=com (1)
objectClass: groupOfNames
cn: admins
owner: cn=admin,dc=example,dc=com
description: System Administrators
member: cn=Jane,ou=users,dc=example,dc=com (2)
member: cn=Jim,ou=users,dc=example,dc=com
```

1. The group is a first-class entry in the LDAP server.
2. Members of a group are listed with an identifying reference as attributes on the group.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **rfc2307_config.yaml** file:

```
$ oc adm groups sync --sync-config=rfc2307_config.yaml --confirm
```

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift Container Platform group created by using the rfc2307_config.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400 (1)
    openshift.io/ldap.uid: cn=admins,ou=groups,dc=example,dc=com (2)
    openshift.io/ldap.url: LDAP_SERVER_IP:389 (3)
  creationTimestamp:
  name: admins (4)
```

```
users: 5
- jane.smith@example.com
- jim.adams@example.com
```

1. The last time this OpenShift Container Platform group was synchronized with the LDAP server, in ISO 6801 format.
2. The unique identifier for the group on the LDAP server.
3. The IP address and host of the LDAP server where this group's record is stored.
4. The name of the group as specified by the sync file.
5. The users that are members of the group, named as specified by the sync file.

14.4.2. Syncing groups using the RFC2307 schema with user-defined name mappings

When syncing groups with user-defined name mappings, the configuration file changes to contain these mappings as shown below.

LDAP sync configuration that uses RFC 2307 schema with user-defined name mappings: rfc2307_config_user_defined.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
groupUIDNameMapping:
  "cn=admins,ou=groups,dc=example,dc=com": Administrators 1
rfc2307:
    groupsQuery:
        baseDN: "ou=groups,dc=example,dc=com"
        scope: sub
        derefAliases: never
        pageSize: 0
    groupUIDAttribute: dn 2
    groupNameAttributes: [ cn ] 3
    groupMembershipAttributes: [ member ]
    usersQuery:
        baseDN: "ou=users,dc=example,dc=com"
        scope: sub
        derefAliases: never
        pageSize: 0
    userUIDAttribute: dn 4
    userNameAttributes: [ mail ]
    tolerateMemberNotFoundErrors: false
    tolerateMemberOutOfScopeErrors: false
```

1. The user-defined name mapping.
2. The unique identifier attribute that is used for the keys in the user-defined name mapping. You cannot specify **groupsQuery** filters when using DN for groupUIDAttribute. For fine-grained filtering, use the whitelist / blacklist method.

3 The attribute to name OpenShift Container Platform groups with if their unique identifier is not in the user-defined name mapping.

4 The attribute that uniquely identifies a user on the LDAP server. You cannot specify **usersQuery** filters when using DN for userUIDAttribute. For fine-grained filtering, use the whitelist / blacklist method.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **rfc2307_config_user_defined.yaml** file:

```
$ oc adm groups sync --sync-config=rfc2307_config_user_defined.yaml --confirm
```

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift Container Platform group created by using the rfc2307_config_user_defined.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400
    openshift.io/ldap.uid: cn=admins,ou=groups,dc=example,dc=com
    openshift.io/ldap.url: LDAP_SERVER_IP:389
  creationTimestamp:
  name: Administrators 1
users:
- jane.smith@example.com
- jim.adams@example.com
```

1 The name of the group as specified by the user-defined name mapping.

14.4.3. Syncing groups using RFC 2307 with user-defined error tolerances

By default, if the groups being synced contain members whose entries are outside of the scope defined in the member query, the group sync fails with an error:

```
Error determining LDAP group membership for "<group>": membership lookup for user "<user>" in group "<group>" failed because of "search for entry with dn="<user-dn>" would search outside of the base dn specified (dn="<base-dn>")".
```

This often indicates a misconfigured **baseDN** in the **usersQuery** field. However, in cases where the **baseDN** intentionally does not contain some of the members of the group, setting **tolerateMemberOutOfScopeErrors: true** allows the group sync to continue. Out of scope members will be ignored.

Similarly, when the group sync process fails to locate a member for a group, it fails outright with errors:

```
Error determining LDAP group membership for "<group>": membership lookup for user "<user>" in group "<group>" failed because of "search for entry with base dn="<user-dn>" refers to a non-existent entry".
Error determining LDAP group membership for "<group>": membership lookup for user "<user>" in group "<group>" failed because of "search for entry with base dn="<user-dn>" and filter "<filter>" did not return any results".
```

This often indicates a misconfigured **usersQuery** field. However, in cases where the group contains member entries that are known to be missing, setting **tolerateMemberNotFoundErrors: true** allows the group sync to continue. Problematic members will be ignored.

WARNING

Enabling error tolerances for the LDAP group sync causes the sync process to ignore problematic member entries. If the LDAP group sync is not configured correctly, this could result in synced OpenShift Container Platform groups missing members.

LDAP entries that use RFC 2307 schema with problematic group membership: rfc2307_problematic_users.ldif

```
dn: ou=users,dc=example,dc=com
objectClass: organizationalUnit
ou: users
dn: cn=Jane,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
cn: Jane
sn: Smith
displayName: Jane Smith
mail: jane.smith@example.com
dn: cn=Jim,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
cn: Jim
sn: Adams
displayName: Jim Adams
mail: jim.adams@example.com
dn: ou=groups,dc=example,dc=com
objectClass: organizationalUnit
ou: groups
dn: cn=admins,ou=groups,dc=example,dc=com
objectClass: groupOfNames
cn: admins
owner: cn=admin,dc=example,dc=com
description: System Administrators
```

```
member: cn=Jane,ou=users,dc=example,dc=com
member: cn=Jim,ou=users,dc=example,dc=com
member: cn=INVALID,ou=users,dc=example,dc=com (1)
member: cn=Jim,ou=OUTOFSCOPE,dc=example,dc=com (2)
```

1. A member that does not exist on the LDAP server.
2. A member that may exist, but is not under the **baseDN** in the user query for the sync job.

In order to tolerate the errors in the above example, the following additions to your sync configuration file must be made:

LDAP sync configuration that uses RFC 2307 schema tolerating errors: rfc2307_config_tolerating.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
url: ldap://LDAP_SERVICE_IP:389
rfc2307:
    groupsQuery:
        baseDN: "ou=groups,dc=example,dc=com"
        scope: sub
        derefAliases: never
    groupUIDAttribute: dn
    groupNameAttributes: [ cn ]
    groupMembershipAttributes: [ member ]
    usersQuery:
        baseDN: "ou=users,dc=example,dc=com"
        scope: sub
        derefAliases: never
    userUIDAttribute: dn (1)
    userNameAttributes: [ mail ]
    tolerateMemberNotFoundErrors: true (2)
    tolerateMemberOutOfScopeErrors: true (3)
```

1. The attribute that uniquely identifies a user on the LDAP server. You cannot specify **usersQuery** filters when using DN for userUIDAttribute. For fine-grained filtering, use the whitelist / blacklist method.
2. When **true**, the sync job tolerates groups for which some members were not found, and members whose LDAP entries are not found are ignored. The default behavior for the sync job is to fail if a member of a group is not found.
3. When **true**, the sync job tolerates groups for which some members are outside the user scope given in the **usersQuery** base DN, and members outside the member query scope are ignored. The default behavior for the sync job is to fail if a member of a group is out of scope.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **rfc2307_config_tolerating.yaml** file:

```
$ oc adm groups sync --sync-config=rfc2307_config_tolerating.yaml --confirm
```

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift Container Platform group created by using the rfc2307_config.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400
    openshift.io/ldap.uid: cn=admins,ou=groups,dc=example,dc=com
    openshift.io/ldap.url: LDAP_SERVER_IP:389
  creationTimestamp:
  name: admins
users: (1)
- jane.smith@example.com
- jim.adams@example.com
```

(1) The users that are members of the group, as specified by the sync file. Members for which lookup encountered tolerated errors are absent.

14.4.4. Syncing groups using the Active Directory schema

In the Active Directory schema, both users (Jane and Jim) exist in the LDAP server as first-class entries, and group membership is stored in attributes on the user. The following snippet of **ldif** defines the users and group for this schema:

LDAP entries that use Active Directory schema: active_directory.ldif

```
dn: ou=users,dc=example,dc=com
objectClass: organizationalUnit
ou: users

dn: cn=Jane,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
cn: Jane
sn: Smith
displayName: Jane Smith
mail: jane.smith@example.com
memberOf: admins (1)

dn: cn=Jim,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
```

```
cn: Jim
sn: Adams
displayName: Jim Adams
mail: jim.adams@example.com
memberOf: admins
```

1 The user's group memberships are listed as attributes on the user, and the group does not exist as an entry on the server. The **memberOf** attribute does not have to be a literal attribute on the user; in some LDAP servers, it is created during search and returned to the client, but not committed to the database.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **active_directory_config.yaml** file:

```
$ oc adm groups sync --sync-config=active_directory_config.yaml --confirm
```

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift Container Platform group created by using the active_directory_config.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400 1
    openshift.io/ldap.uid: admins 2
    openshift.io/ldap.url: LDAP_SERVER_IP:389 3
  creationTimestamp:
  name: admins 4
users: 5
- jane.smith@example.com
- jim.adams@example.com
```

1 The last time this OpenShift Container Platform group was synchronized with the LDAP server, in ISO 6801 format.

2 The unique identifier for the group on the LDAP server.

3 The IP address and host of the LDAP server where this group's record is stored.

4 The name of the group as listed in the LDAP server.

5 The users that are members of the group, named as specified by the sync file.

14.4.5. Syncing groups using the augmented Active Directory schema

In the augmented Active Directory schema, both users (Jane and Jim) and groups exist in the LDAP server as first-class entries, and group membership is stored in attributes on the user. The following snippet of **ldif** defines the users and group for this schema:

LDAP entries that use augmented Active Directory schema: augmented_active_directory.ldif

```
dn: ou=users,dc=example,dc=com
objectClass: organizationalUnit
ou: users

dn: cn=Jane,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
cn: Jane
sn: Smith
displayName: Jane Smith
mail: jane.smith@example.com
memberOf: cn=admins,ou=groups,dc=example,dc=com (1)

dn: cn=Jim,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
cn: Jim
sn: Adams
displayName: Jim Adams
mail: jim.adams@example.com
memberOf: cn=admins,ou=groups,dc=example,dc=com

dn: ou=groups,dc=example,dc=com
objectClass: organizationalUnit
ou: groups

dn: cn=admins,ou=groups,dc=example,dc=com (2)
objectClass: groupOfNames
cn: admins
owner: cn=admin,dc=example,dc=com
description: System Administrators
member: cn=Jane,ou=users,dc=example,dc=com
member: cn=Jim,ou=users,dc=example,dc=com
```

(1) The user's group memberships are listed as attributes on the user.

(2) The group is a first-class entry on the LDAP server.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **augmented_active_directory_config.yaml** file:

```
$ oc adm groups sync --sync-config=augmented_active_directory_config.yaml --confirm
```

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift group created by using the augmented_active_directory_config.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400 (1)
    openshift.io/ldap.uid: cn=admins,ou=groups,dc=example,dc=com (2)
    openshift.io/ldap.url: LDAP_SERVER_IP:389 (3)
  creationTimestamp:
  name: admins (4)
users: (5)
- jane.smith@example.com
- jim.adams@example.com
```

1. The last time this OpenShift Container Platform group was synchronized with the LDAP server, in ISO 6801 format.
2. The unique identifier for the group on the LDAP server.
3. The IP address and host of the LDAP server where this group's record is stored.
4. The name of the group as specified by the sync file.
5. The users that are members of the group, named as specified by the sync file.

14.4.5.1. LDAP nested membership sync example

Groups in OpenShift Container Platform do not nest. The LDAP server must flatten group membership before the data can be consumed. Microsoft's Active Directory Server supports this feature via the **LDAP_MATCHING_RULE_IN_CHAIN** rule, which has the OID **1.2.840.113556.1.4.1941**. Furthermore, only explicitly whitelisted groups can be synced when using this matching rule.

This section has an example for the augmented Active Directory schema, which synchronizes a group named **admins** that has one user **Jane** and one group **otheradmins** as members. The **otheradmins** group has one user member: **Jim**. This example explains:

- How the group and users are added to the LDAP server.
- What the LDAP sync configuration file looks like.
- What the resulting group record in OpenShift Container Platform will be after synchronization.

In the augmented Active Directory schema, both users (**Jane** and **Jim**) and groups exist in the LDAP server as first-class entries, and group membership is stored in attributes on the user or the group. The following snippet of **ldif** defines the users and groups for this schema:

LDAP entries that use augmented Active Directory schema with nested members:
augmented_active_directory_nested.ldif

```
dn: ou=users,dc=example,dc=com
objectClass: organizationalUnit
ou: users

dn: cn=Jane,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
cn: Jane
sn: Smith
displayName: Jane Smith
mail: jane.smith@example.com
memberOf: cn=admins,ou=groups,dc=example,dc=com (1)

dn: cn=Jim,ou=users,dc=example,dc=com
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
objectClass: testPerson
cn: Jim
sn: Adams
displayName: Jim Adams
mail: jim.adams@example.com
memberOf: cn=otheradmins,ou=groups,dc=example,dc=com (2)

dn: ou=groups,dc=example,dc=com
objectClass: organizationalUnit
ou: groups

dn: cn=admins,ou=groups,dc=example,dc=com (3)
objectClass: group
cn: admins
owner: cn=admin,dc=example,dc=com
description: System Administrators
member: cn=Jane,ou=users,dc=example,dc=com
member: cn=otheradmins,ou=groups,dc=example,dc=com

dn: cn=otheradmins,ou=groups,dc=example,dc=com (4)
objectClass: group
cn: otheradmins
owner: cn=admin,dc=example,dc=com
description: Other System Administrators
memberOf: cn=admins,ou=groups,dc=example,dc=com (5) (6)
member: cn=Jim,ou=users,dc=example,dc=com
```

(1) (2) (5) The user's and group's memberships are listed as attributes on the object.

(3) (4) The groups are first-class entries on the LDAP server.

(6) The **otheradmins** group is a member of the **admins** group.

When syncing nested groups with Active Directory, you must provide an LDAP query definition for both user entries and group entries, as well as the attributes with which to represent them in the internal OpenShift Container Platform group records. Furthermore, certain changes are required in this configuration:

- The **oc adm groups sync** command must explicitly whitelist groups.
- The user's **groupMembershipAttributes** must include **"memberOf:1.2.840.113556.1.4.1941:"** to comply with the **LDAP_MATCHING_RULE_IN_CHAIN** rule.
- The **groupUIDAttribute** must be set to **dn**.
- The **groupsQuery**:
  - Must not set **filter**.
  - Must set a valid **derefAliases**.
  - Should not set **baseDN** as that value is ignored.
  - Should not set **scope** as that value is ignored.

For clarity, the group you create in OpenShift Container Platform should use attributes other than the distinguished name whenever possible for user- or administrator-facing fields. For example, identify the users of an OpenShift Container Platform group by their e-mail, and use the name of the group as the common name. The following configuration file creates these relationships:

LDAP sync configuration that uses augmented Active Directory schema with nested members: augmented_active_directory_config_nested.yaml

```
kind: LDAPSyncConfig
apiVersion: v1
url: ldap://LDAP_SERVICE_IP:389
augmentedActiveDirectory:
  groupsQuery: (1)
    derefAliases: never
    pageSize: 0
  groupUIDAttribute: dn (2)
  groupNameAttributes: [ cn ] (3)
  usersQuery:
    baseDN: "ou=users,dc=example,dc=com"
    scope: sub
    derefAliases: never
    filter: (objectclass=person)
    pageSize: 0
  userNameAttributes: [ mail ] (4)
  groupMembershipAttributes: [ "memberOf:1.2.840.113556.1.4.1941:" ] (5)
```

(1) **groupsQuery** filters cannot be specified. The **groupsQuery** base DN and scope values are ignored. **groupsQuery** must set a valid **derefAliases**.

(2) The attribute that uniquely identifies a group on the LDAP server. It must be set to **dn**.

(3) The attribute to use as the name of the group.

4 The attribute to use as the name of the user in the OpenShift Container Platform group record. **mail** or **sAMAccountName** are preferred choices in most installations.

5 The attribute on the user that stores the membership information. Note the use of **LDAP_MATCHING_RULE_IN_CHAIN**.

Prerequisites

- Create the configuration file.

Procedure

- Run the sync with the **augmented_active_directory_config_nested.yaml** file:

```
$ oc adm groups sync \
   'cn=admins,ou=groups,dc=example,dc=com' \
   --sync-config=augmented_active_directory_config_nested.yaml \
   --confirm
```

NOTE

You must explicitly whitelist the **cn=admins,ou=groups,dc=example,dc=com** group.

OpenShift Container Platform creates the following group record as a result of the above sync operation:

OpenShift group created by using the augmented_active_directory_config_nested.yaml file

```
apiVersion: user.openshift.io/v1
kind: Group
metadata:
  annotations:
    openshift.io/ldap.sync-time: 2015-10-13T10:08:38-0400 1
    openshift.io/ldap.uid: cn=admins,ou=groups,dc=example,dc=com 2
    openshift.io/ldap.url: LDAP_SERVER_IP:389 3
  creationTimestamp:
  name: admins 4
users: 5
- jane.smith@example.com
- jim.adams@example.com
```

1 The last time this OpenShift Container Platform group was synchronized with the LDAP server, in ISO 6801 format.

2 The unique identifier for the group on the LDAP server.

3 The IP address and host of the LDAP server where this group's record is stored.

4 The name of the group as specified by the sync file.

5 The users that are members of the group, named as specified by the sync file. Note that members of nested groups are included since the group membership was flattened by the

14.5. LDAP SYNC CONFIGURATION SPECIFICATION

The object specification for the configuration file is below. Note that the different schema objects have different fields. For example, v1.ActiveDirectoryConfig has no **groupsQuery** field whereas v1.RFC2307Config and v1.AugmentedActiveDirectoryConfig both do.

IMPORTANT

There is no support for binary attributes. All attribute data coming from the LDAP server must be in the format of a UTF-8 encoded string. For example, never use a binary attribute, such as **objectGUID**, as an ID attribute. You must use string attributes, such as **sAMAccountName** or **userPrincipalName**, instead.

14.5.1. v1.LDAPSyncConfig

LDAPSyncConfig holds the necessary configuration options to define an LDAP group sync.

Name	Description	Schema
kind	String value representing the REST resource this object represents. Servers may infer this from the endpoint the client submits requests to. Cannot be updated. In CamelCase. More info: https://github.com/kubernetes/community/blob/master/contributors/devel/sig-architecture/api-conventions.md#types-kinds	string
apiVersion	Defines the versioned schema of this representation of an object. Servers should convert recognized schemas to the latest internal value, and may reject unrecognized values. More info: https://github.com/kubernetes/community/blob/master/contributors/devel/sig-architecture/api-conventions.md#resources	string
url	Host is the scheme, host and port of the LDAP server to connect to: **scheme://host:port**	string
bindDN	Optional DN to bind to the LDAP server with.	string

Name	Description	Schema
bindPassword	Optional password to bind with during the search phase.	v1.StringSource
insecure	If **true**, indicates the connection should not use TLS. If **false**, **ldaps://** URLs connect using TLS, and **ldap://** URLs are upgraded to a TLS connection using StartTLS as specified in https://tools.ietf.org/html/rfc2830. If you set **insecure** to **true**, you cannot use **ldaps://** URL schemes.	boolean
ca	Optional trusted certificate authority bundle to use when making requests to the server. If empty, the default system roots are used.	string
groupUIDNameMapping	Optional direct mapping of LDAP group UIDs to OpenShift Container Platform group names.	object
rfc2307	Holds the configuration for extracting data from an LDAP server set up in a fashion similar to RFC2307: first-class group and user entries, with group membership determined by a multi-valued attribute on the group entry listing its members.	v1.RFC2307Config
activeDirectory	Holds the configuration for extracting data from an LDAP server set up in a fashion similar to that used in Active Directory: first-class user entries, with group membership determined by a multi-valued attribute on members listing groups they are a member of.	v1.ActiveDirectoryConfig

Name	Description	Schema
augmentedActiveDirectory	Holds the configuration for extracting data from an LDAP server set up in a fashion similar to that used in Active Directory as described above, with one addition: first-class group entries exist and are used to hold metadata but not group membership.	v1.AugmentedActiveDirectoryConfig

14.5.2. v1.StringSource

StringSource allows specifying a string inline, or externally via environment variable or file. When it contains only a string value, it marshals to a simple JSON string.

Name	Description	Schema
value	Specifies the cleartext value, or an encrypted value if **keyFile** is specified.	string
env	Specifies an environment variable containing the cleartext value, or an encrypted value if the **keyFile** is specified.	string
file	References a file containing the cleartext value, or an encrypted value if a **keyFile** is specified.	string
keyFile	References a file containing the key to use to decrypt the value.	string

14.5.3. v1.LDAPQuery

LDAPQuery holds the options necessary to build an LDAP query.

Name	Description	Schema
baseDN	DN of the branch of the directory where all searches should start from.	string

Name	Description	Schema
scope	The optional scope of the search. Can be **base**: only the base object, **one**: all objects on the base level, **sub**: the entire subtree. Defaults to **sub** if not set.	string
derefAliases	The optional behavior of the search with regards to alisases. Can be **never**: never dereference aliases, **search**: only dereference in searching, **base**: only dereference in finding the base object, **always**: always dereference. Defaults to **always** if not set.	string
timeout	Holds the limit of time in seconds that any request to the server can remain outstanding before the wait for a response is given up. If this is **0**, no client-side limit is imposed.	integer
filter	A valid LDAP search filter that retrieves all relevant entries from the LDAP server with the base DN.	string
pageSize	Maximum preferred page size, measured in LDAP entries. A page size of **0** means no paging will be done.	integer

14.5.4. v1.RFC2307Config

RFC2307Config holds the necessary configuration options to define how an LDAP group sync interacts with an LDAP server using the RFC2307 schema.

Name	Description	Schema
groupsQuery	Holds the template for an LDAP query that returns group entries.	v1.LDAPQuery

Name	Description	Schema
groupUIDAttribute	Defines which attribute on an LDAP group entry will be interpreted as its unique identifier. (**ldapGroupUID**)	string
groupNameAttributes	Defines which attributes on an LDAP group entry will be interpreted as its name to use for an OpenShift Container Platform group.	string array
groupMembershipAttributes	Defines which attributes on an LDAP group entry will be interpreted as its members. The values contained in those attributes must be queryable by your **UserUIDAttribute**.	string array
usersQuery	Holds the template for an LDAP query that returns user entries.	v1.LDAPQuery
userUIDAttribute	Defines which attribute on an LDAP user entry will be interpreted as its unique identifier. It must correspond to values that will be found from the **GroupMembershipAttributes**.	string
userNameAttributes	Defines which attributes on an LDAP user entry will be used, in order, as its OpenShift Container Platform user name. The first attribute with a non-empty value is used. This should match your **PreferredUsername** setting for your **LDAPPasswordIdentityProvider**. The attribute to use as the name of the user in the OpenShift Container Platform group record. **mail** or **sAMAccountName** are preferred choices in most installations.	string array

Name	Description	Schema
tolerateMemberNotFoundErrors	Determines the behavior of the LDAP sync job when missing user entries are encountered. If **true**, an LDAP query for users that does not find any will be tolerated and an only and error will be logged. If **false**, the LDAP sync job will fail if a query for users doesn't find any. The default value is **false**. Misconfigured LDAP sync jobs with this flag set to **true** can cause group membership to be removed, so it is recommended to use this flag with caution.	boolean
tolerateMemberOutOfScopeErrors	Determines the behavior of the LDAP sync job when out-of-scope user entries are encountered. If **true**, an LDAP query for a user that falls outside of the base DN given for the all user query will be tolerated and only an error will be logged. If **false**, the LDAP sync job will fail if a user query would search outside of the base DN specified by the all user query. Misconfigured LDAP sync jobs with this flag set to **true** can result in groups missing users, so it is recommended to use this flag with caution.	boolean

14.5.5. v1.ActiveDirectoryConfig

ActiveDirectoryConfig holds the necessary configuration options to define how an LDAP group sync interacts with an LDAP server using the Active Directory schema.

Name	Description	Schema
usersQuery	Holds the template for an LDAP query that returns user entries.	v1.LDAPQuery

Name	Description	Schema
userNameAttributes	Defines which attributes on an LDAP user entry will be interpreted as its OpenShift Container Platform user name. The attribute to use as the name of the user in the OpenShift Container Platform group record. **mail** or **sAMAccountName** are preferred choices in most installations.	string array
groupMembershipAttributes	Defines which attributes on an LDAP user entry will be interpreted as the groups it is a member of.	string array

14.5.6. v1.AugmentedActiveDirectoryConfig

AugmentedActiveDirectoryConfig holds the necessary configuration options to define how an LDAP group sync interacts with an LDAP server using the augmented Active Directory schema.

Name	Description	Schema
usersQuery	Holds the template for an LDAP query that returns user entries.	v1.LDAPQuery
userNameAttributes	Defines which attributes on an LDAP user entry will be interpreted as its OpenShift Container Platform user name. The attribute to use as the name of the user in the OpenShift Container Platform group record. **mail** or **sAMAccountName** are preferred choices in most installations.	string array
groupMembershipAttributes	Defines which attributes on an LDAP user entry will be interpreted as the groups it is a member of.	string array
groupsQuery	Holds the template for an LDAP query that returns group entries.	v1.LDAPQuery

Name	Description	Schema
groupUIDAttribute	Defines which attribute on an LDAP group entry will be interpreted as its unique identifier. (**ldapGroupUID**)	string
groupNameAttributes	Defines which attributes on an LDAP group entry will be interpreted as its name to use for an OpenShift Container Platform group.	string array

CHAPTER 15. CREATING AND USING CONFIG MAPS

The following sections define config maps and how to create and use them.

15.1. UNDERSTANDING CONFIGMAPS

Many applications require configuration using some combination of configuration files, command line arguments, and environment variables. In OpenShift Container Platform, these configuration artifacts are decoupled from image content in order to keep containerized applications portable.

The **ConfigMap** object provides mechanisms to inject containers with configuration data while keeping containers agnostic of OpenShift Container Platform. A config map can be used to store fine-grained information like individual properties or coarse-grained information like entire configuration files or JSON blobs.

The **ConfigMap** API object holds key-value pairs of configuration data that can be consumed in pods or used to store configuration data for system components such as controllers. For example:

ConfigMap Object Definition

```
kind: ConfigMap
apiVersion: v1
metadata:
  creationTimestamp: 2016-02-18T19:14:38Z
  name: example-config
  namespace: default
data: 1
  example.property.1: hello
  example.property.2: world
  example.property.file: |-
    property.1=value-1
    property.2=value-2
    property.3=value-3
binaryData:
  bar: L3Jvb3QvMTAw 2
```

1 Contains the configuration data.

2 Points to a file that contains non-UTF8 data, for example, a binary Java keystore file. Enter the file data in Base 64.

NOTE

You can use the **binaryData** field when you create a config map from a binary file, such as an image.

Configuration data can be consumed in pods in a variety of ways. A config map can be used to:

- Populate environment variable values in containers
- Set command-line arguments in a container
- Populate configuration files in a volume

Users and system components can store configuration data in a config map.

A config map is similar to a secret, but designed to more conveniently support working with strings that do not contain sensitive information.

Config map restrictions

A config map must be created before its contents can be consumed in pods.

Controllers can be written to tolerate missing configuration data. Consult individual components configured by using config maps on a case-by-case basis.

ConfigMap objects reside in a project.

They can only be referenced by pods in the same project.

The Kubelet only supports the use of a config map for pods it gets from the API server.

This includes any pods created by using the CLI, or indirectly from a replication controller. It does not include pods created by using the OpenShift Container Platform node's **--manifest-url** flag, its **--config** flag, or its REST API because these are not common ways to create pods.

15.2. CREATING A CONFIG MAP IN THE OPENSHIFT CONTAINER PLATFORM WEB CONSOLE

You can create a config map in the OpenShift Container Platform web console.

Procedure

- To create a config map as a cluster administrator:
  1. In the Administrator perspective, select **Workloads → Config Maps**.
  2. At the top right side of the page, select **Create Config Map**.
  3. Enter the contents of your config map.
  4. Select **Create**.
- To create a config map as a developer:
  1. In the Developer perspective, select **Config Maps**.
  2. At the top right side of the page, select **Create Config Map**.
  3. Enter the contents of your config map.
  4. Select **Create**.

15.3. CREATING A CONFIG MAP

You can use the following command to create a config map from directories, specific files, or literal values.

Procedure

- Create a config map:

```
$ oc create configmap <configmap_name> [options]
```

15.3.1. Creating a config map from a directory

You can create a config map from a directory. This method allows you to use multiple files within a directory to create a config map.

Procedure

The following example procedure outlines how to create a config map from a directory.

1. Start with a directory with some files that already contain the data with which you want to populate a config map:

```
$ ls example-files
```

Example output

```
game.properties
ui.properties
```

```
$ cat example-files/game.properties
```

Example output

```
enemies=aliens
lives=3
enemies.cheat=true
enemies.cheat.level=noGoodRotten
secret.code.passphrase=UUDDLRLRBABAS
secret.code.allowed=true
secret.code.lives=30
```

```
$ cat example-files/ui.properties
```

Example output

```
color.good=purple
color.bad=yellow
allow.textmode=true
how.nice.to.look=fairlyNice
```

2. Create a **ConfigMap** holding the content of each file in this directory by entering the following command:

```
$ oc create configmap game-config \
    --from-file=example-files/
```

When the **--from-file** option points to a directory, each file directly in that directory is used to populate a key in the **ConfigMap**, where the name of the key is the file name, and the value of the key is the content of the file.

For example, the previous command creates the following **ConfigMap**:

```
$ oc describe configmaps game-config
```

Example output

```
Name:           game-config
Namespace:      default
Labels:         <none>
Annotations:    <none>

Data

game.properties:        158 bytes
ui.properties:          83 bytes
```

You can see that the two keys in the map are created from the file names in the directory specified in the command. Because the content of those keys might be large, the output of **oc describe** only shows the names of the keys and their sizes.

3. Enter the **oc get** command for the object with the **-o** option to see the values of the keys:

```
$ oc get configmaps game-config -o yaml
```

Example output

```
apiVersion: v1
data:
  game.properties: |-
    enemies=aliens
    lives=3
    enemies.cheat=true
    enemies.cheat.level=noGoodRotten
    secret.code.passphrase=UUDDLRLRBABAS
    secret.code.allowed=true
    secret.code.lives=30
  ui.properties: |
    color.good=purple
    color.bad=yellow
    allow.textmode=true
    how.nice.to.look=fairlyNice
kind: ConfigMap
metadata:
  creationTimestamp: 2016-02-18T18:34:05Z
  name: game-config
  namespace: default
  resourceVersion: "407"-
  selflink: /api/v1/namespaces/default/configmaps/game-config
  uid: 30944725-d66e-11e5-8cd0-68f728db1985
```

15.3.2. Creating a ConfigMap from a file

You can create a config map from a file.

Procedure

The following example procedure outlines how to create a config map from a file.

NOTE

If you create a config map from a file, you can include files containing non-UTF8 data that are placed in this field without corrupting the non-UTF8 data. OpenShift Container Platform detects binary files and transparently encodes the file as **MIME**. On the server, the **MIME** payload is decoded and stored without corrupting the data.

You can pass the **--from-file** option multiple times to the CLI. The following example yields equivalent results to the creating from directories example.

1. Create a **ConfigMap** specifying a specific file:

```
$ oc create configmap game-config-2 \
    --from-file=example-files/game.properties \
    --from-file=example-files/ui.properties
```

2. Verify the results:

```
$ oc get configmaps game-config-2 -o yaml
```

Example output

```
apiVersion: v1
data:
  game.properties: |-
    enemies=aliens
    lives=3
    enemies.cheat=true
    enemies.cheat.level=noGoodRotten
    secret.code.passphrase=UUDDLRLRBABAS
    secret.code.allowed=true
    secret.code.lives=30
  ui.properties: |
    color.good=purple
    color.bad=yellow
    allow.textmode=true
    how.nice.to.look=fairlyNice
kind: ConfigMap
metadata:
  creationTimestamp: 2016-02-18T18:52:05Z
  name: game-config-2
  namespace: default
  resourceVersion: "516"
  selflink: /api/v1/namespaces/default/configmaps/game-config-2
  uid: b4952dc3-d670-11e5-8cd0-68f728db1985
```

You can specify the key to set in a **ConfigMap** for content imported from a file. This can be set by passing a **key=value** expression to the **--from-file** option. For example:

1. Create a **ConfigMap** specifying a key-value pair:

```
$ oc create configmap game-config-3 \
    --from-file=game-special-key=example-files/game.properties
```

2. Verify the results:

```
$ oc get configmaps game-config-3 -o yaml
```

Example output

```
apiVersion: v1
data:
  game-special-key: |- (1)
    enemies=aliens
    lives=3
    enemies.cheat=true
    enemies.cheat.level=noGoodRotten
    secret.code.passphrase=UUDDLRLRBABAS
    secret.code.allowed=true
    secret.code.lives=30
kind: ConfigMap
metadata:
  creationTimestamp: 2016-02-18T18:54:22Z
  name: game-config-3
  namespace: default
  resourceVersion: "530"
  selflink: /api/v1/namespaces/default/configmaps/game-config-3
  uid: 05f8da22-d671-11e5-8cd0-68f728db1985
```

(1) This is the key that you set in the preceding step.

15.3.3. Creating a config map from literal values

You can supply literal values for a config map.

Procedure

The **--from-literal** option takes a **key=value** syntax that allows literal values to be supplied directly on the command line.

1. Create a **ConfigMap** specifying a literal value:

```
$ oc create configmap special-config \
    --from-literal=special.how=very \
    --from-literal=special.type=charm
```

2. Verify the results:

```
$ oc get configmaps special-config -o yaml
```

Example output

```
apiVersion: v1
```

```
data:
  special.how: very
  special.type: charm
kind: ConfigMap
metadata:
  creationTimestamp: 2016-02-18T19:14:38Z
  name: special-config
  namespace: default
  resourceVersion: "651"
  selflink: /api/v1/namespaces/default/configmaps/special-config
  uid: dadce046-d673-11e5-8cd0-68f728db1985
```

15.4. USE CASES: CONSUMING CONFIGMAPS IN PODS

The following sections describe some uses cases when consuming **ConfigMap** objects in pods.

15.4.1. Populating environment variables in containers by using config maps

Config maps can be used to populate individual environment variables in containers or to populate environment variables in containers from all keys that form valid environment variable names.

As an example, consider the following config map:

ConfigMap with two environment variables

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: special-config 1
  namespace: default 2
data:
  special.how: very 3
  special.type: charm 4
```

1 Name of the **ConfigMap**.

2 The project in which the **ConfigMap** resides. Config maps can only be referenced by pods in the same project.

3 4 Environment variables to inject.

ConfigMap with one environment variable

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: env-config 1
  namespace: default
data:
  log_level: INFO 2
```

1 Name of the **ConfigMap**.

2 Environment variable to inject.

Procedure

- You can consume the keys of this **ConfigMap** in a pod using **configMapKeyRef** sections.

Sample Pod specification configured to inject specific environment variables

```
apiVersion: v1
kind: Pod
metadata:
  name: dapi-test-pod
spec:
  containers:
    - name: test-container
      image: gcr.io/google_containers/busybox
      command: [ "/bin/sh", "-c", "env" ]
      env: 1
        - name: SPECIAL_LEVEL_KEY 2
          valueFrom:
            configMapKeyRef:
              name: special-config 3
              key: special.how 4
        - name: SPECIAL_TYPE_KEY
          valueFrom:
            configMapKeyRef:
              name: special-config 5
              key: special.type 6
              optional: true 7
      envFrom: 8
        - configMapRef:
            name: env-config 9
  restartPolicy: Never
```

1 Stanza to pull the specified environment variables from a **ConfigMap**.

2 Name of a Pod environment variable that you are injecting a key's value into.

3 5 Name of the **ConfigMap** to pull specific environment variables from.

4 6 Environment variable to pull from the **ConfigMap**.

7 Makes the environment variable optional. As optional, the Pod will be started even if the specified **ConfigMap** and keys do not exist.

8 Stanza to pull all environment variables from a **ConfigMap**.

9 Name of the **ConfigMap** to pull all environment variables from.

When this Pod is run, the Pod logs will include the following output:

```
SPECIAL_LEVEL_KEY=very
log_level=INFO
```

NOTE

SPECIAL_TYPE_KEY=charm is not listed in the example output because **optional: true** is set.

15.4.2. Setting command-line arguments for container commands with ConfigMaps

A ConfigMap can also be used to set the value of the commands or arguments in a container. This is accomplished by using the Kubernetes substitution syntax **$(VAR_NAME)**. Consider the following ConfigMaps:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: special-config
  namespace: default
data:
  special.how: very
  special.type: charm
```

Procedure

- To inject values into a command in a container, you must consume the keys you want to use as environment variables, as in the consuming ConfigMaps in environment variables use case. Then you can refer to them in a container's command using the **$(VAR_NAME)** syntax.

  Sample Pod specification configured to inject specific environment variables

```
apiVersion: v1
kind: Pod
metadata:
  name: dapi-test-pod
spec:
  containers:
    - name: test-container
      image: gcr.io/google_containers/busybox
      command: [ "/bin/sh", "-c", "echo $(SPECIAL_LEVEL_KEY) $(SPECIAL_TYPE_KEY)" ]
(1)
      env:
        - name: SPECIAL_LEVEL_KEY
          valueFrom:
            configMapKeyRef:
              name: special-config
              key: special.how
        - name: SPECIAL_TYPE_KEY
          valueFrom:
            configMapKeyRef:
              name: special-config
              key: special.type
  restartPolicy: Never
```

1 Inject the values into a command in a container using the keys you want to use as environment variables.

When this Pod is run, the output from the echo command run in the test-container container is as follows:

```
very charm
```

15.4.3. Injecting content into a volume by using config maps

You can inject content into a volume by using config maps.

Example ConfigMap

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: special-config
  namespace: default
data:
  special.how: very
  special.type: charm
```

Procedure

You have a couple different options for injecting content into a volume by using config maps.

- The most basic way to inject content into a volume by using a config map is to populate the volume with files where the key is the file name and the content of the file is the value of the key:

```
apiVersion: v1
kind: Pod
metadata:
  name: dapi-test-pod
spec:
  containers:
    - name: test-container
      image: gcr.io/google_containers/busybox
      command: [ "/bin/sh", "cat", "/etc/config/special.how" ]
      volumeMounts:
      - name: config-volume
        mountPath: /etc/config
  volumes:
    - name: config-volume
      configMap:
        name: special-config 1
  restartPolicy: Never
```

1 File containing key.

When this pod is run, the output of the cat command will be:

```
very
```

- You can also control the paths within the volume where **ConfigMap** keys are projected:

```
apiVersion: v1
kind: Pod
metadata:
  name: dapi-test-pod
spec:
  containers:
    - name: test-container
      image: gcr.io/google_containers/busybox
      command: [ "/bin/sh", "cat", "/etc/config/path/to/special-key" ]
      volumeMounts:
      - name: config-volume
        mountPath: /etc/config
  volumes:
    - name: config-volume
      configMap:
        name: special-config
        items:
        - key: special.how
          path: path/to/special-key 1
  restartPolicy: Never
```

1 Path to **ConfigMap** key.

When this pod is run, the output of the cat command will be:

```
very
```