

Configuring Authentication in Cloudera Manager

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Overview

Authentication is a process that requires users and services to prove their identity when trying to access a system resource.

Organizations typically manage user identity and authentication through various time-tested technologies, including pluggable authentication modules (PAM), Lightweight Directory Access Protocol (LDAP) for identity, directory, and other services, such as group management, and Kerberos for authentication.

Cloudera clusters support integration with all of these technologies. For example, organizations with existing LDAP directory services such as Active Directory (included in Microsoft Windows Server as part of its suite of Active Directory Services) can leverage the organization's existing user accounts and group listings instead of creating new accounts throughout the cluster. Using an external system such as Active Directory or OpenLDAP can support the user role authorization mechanism.

As an alternative to LDAP, you can use pluggable authentication modules (PAM), which are standard Linux modules used for external authentication. In Cloudera Manager, PAM configuration is simpler than LDAP, and systems administrators can add new authentication methods by installing new PAM modules. If you have multiple LDAP servers, you can configure PAM to synchronize with LDAP using System Security Services Daemon (SSSD), as Cloudera Manager does not otherwise support multiple LDAP servers. You can also configure Cloudera Manager to use Apache Knox for authentication and PAM to look up users and roles stored in LDAP.

For authentication, Cloudera supports integration with MIT Kerberos and with Active Directory. Microsoft Active Directory supports Kerberos for authentication in addition to its identity management and directory functionality, that is, LDAP.

Kerberos provides *strong authentication*, strong meaning that cryptographic mechanisms—rather than passwords alone—are used in the exchange between requesting process and service during the authentication process.

These systems are not mutually exclusive. For example, Microsoft Active Directory is an LDAP directory service that also provides Kerberos authentication services, and Kerberos credentials can be stored and managed in an LDAP directory service. Cloudera Manager Server, CDP nodes, and Cloudera Enterprise components, such as Apache Hive, Hue, and Impala, can all make use of Kerberos authentication.



Note: Cloudera does not provide a Kerberos implementation but rather can use MIT Kerberos or Microsoft Server Active Directory service and its KDC for authentication.

Configuring the cluster to use Kerberos requires having administrator privileges—and access to—the Kerberos server Key Distribution Center (KDC). The process may require debugging issues between the Cloudera Manager cluster and the KDC.



Note: Integrating clusters to use Microsoft Active Directory as a KDC requires the Windows registry setting for AllowTgtSessionKey to be disabled (set to 0). If this registry key has already been enabled, users and credentials are not created—despite the "Successful" message at the end of the configuration/integration process. Before configuring Active Directory for use as KDC, check the value of AllowTgtSessionKey on the Active Directory instance and reset to 0 if necessary.

On each host operating system underlying each node in a cluster, local Linux user:group accounts are created during installation of Cloudera Server and CDP services. These accounts may also be referred to as **Hadoop Users**. These local accounts are blocked from normal login access, and have no password set. This means login on these user accounts is not possible. Customers are advised not to set any password on these local service accounts, as doing so would compromise security.

To apply per-node authentication and authorization mechanism consistently across all the nodes of a cluster, local user:group accounts are mapped to user accounts and groups in an LDAP-compliant directory service, such as Active Directory or OpenLDAP.

To facilitate the authentication process from each host system (node in the cluster) to the LDAP directory, Cloudera recommends using additional software mechanisms such as SSSD or Centrify Server Suite.

Kerberos Security Artifacts Overview

How Cloudera Clusters use Kerberos artifacts such as principals, keytabs, and delegation tokens.

Cloudera recommends using Kerberos for authentication because core Hadoop authentication alone checks only for valid user:group membership in the context of HDFS, but does not authenticate users or services across all network resources, as Kerberos does. Unlike other mechanisms that may be far easier to deploy, the Kerberos protocol authenticates a requesting user or service for a specific period of time only, and each service that the user may want to use requires the appropriate Kerberos artifact in the context of the protocol. This section describes how Cloudera clusters use some of these artifacts, such as Kerberos principals and keytabs for user authentication, and how delegation tokens are used by the system to authenticate jobs on behalf of authenticated users at runtime.

Kerberos Principals

Each user and service that needs to authenticate to Kerberos needs a *principal*, an entity that uniquely identifies the user or service in the context of possibly multiple Kerberos servers and related subsystems. A principal includes up to three pieces of identifying information, starting with the user or service name (called a *primary*). Typically, the primary portion of the principal consists of the user account name from the operating system, such as jcarlos for the user's Unix account or hdfs for the Linux account associated with the service daemon on the host underlying cluster node.

Principals for users typically consist solely of the primary and the Kerberos *realm* name. The realm is a logical grouping of principals tied to the same Key Distribution Center (KDC) which is configured with many of the same properties, such as supported encryption algorithms. Large organizations may use realms as means of delegating administration to various groups or teams for specific sets of users or functions and distributing the authentication-processing tasks across multiple servers.

Standard practice is to use your organization's domain name as the Kerberos realm name (in all uppercase characters) to easily distinguish it as part of a Kerberos principal, as shown in this user principal pattern:

```
username@REALM.EXAMPLE.COM
```

The combination of the primary and the realm name can distinguish one user from another. For example, jcarlos@SOME-REALM.EXAMPLE.COM and jcarlos@ANOTHER-REALM.EXAMPLE.COM may be unique individuals within the same organization.

For service role instance identities, the primary is the Unix account name used by Hadoop daemons (hdfs, mapred, and so on) followed by an *instance* name that identifies the specific host on which the service runs. For example, hdfs/hostname.fqdn.example.com@SOME-REALM.EXAMPLE.COM is an example of the principal for an HDFS service instance. The forward slash (/) separates the primary and the instance names using this basic pattern:

```
service-name/hostname.fqdn.example.com@REALM.EXAMPLE.COM
```

The HTTP principal needed for Hadoop web service interfaces does not have a Unix local account for its primary but rather is HTTP.

An instance name can also identify users with special roles, such as administrators. For example, the principal jcarlos@SOME-REALM.COM and the principal jcarlos/admin@SOME-REALM.COM each have their own passwords and privileges, and they may or may not be the same individual.

For example, the principal for the HDFS service role instance running on a cluster in an organization with realms for each geographical location might be as follows:

```
hdfs/hostname.fqdn.example.com@OAKLAND.EXAMPLE.COM
```

Generally, the service name is the Unix account name used by the given service role instance, such as `hdfs` or `mapred`, as shown above. The HTTP principal for securing web authentication to Hadoop service web interfaces has no Unix account, so the primary for the principal is HTTP.

Kerberos Keytabs

A *keytab* is a file that contains the principal and the encrypted key for the principal. A keytab file for a Hadoop daemon is unique to each host since the principal names include the hostname. This file is used to authenticate a principal on a host to Kerberos without human interaction or storing a password in a plain text file. Because having access to the keytab file for a principal allows one to act as that principal, access to the keytab files should be tightly secured.

They should be readable by a minimal set of users, should be stored on local disk, and should not be included in host backups, unless access to those backups is as secure as access to the local host.

Delegation Tokens

Users in a Hadoop cluster authenticate themselves to the NameNode using their Kerberos credentials. However, once the user is authenticated, each job subsequently submitted must also be checked to ensure it comes from an authenticated user. Since there could be a time gap between a job being submitted and the job being executed, during which the user could have logged off, user credentials are passed to the NameNode using delegation tokens that can be used for authentication in the future.

Delegation tokens are a secret key shared with the NameNode, that can be used to impersonate a user to get a job executed. While these tokens can be renewed, new tokens can only be obtained by clients authenticating to the NameNode using Kerberos credentials. By default, delegation tokens are only valid for a day. However, since jobs can last longer than a day, each token specifies a NodeManager as a renewer which is allowed to renew the delegation token once a day, until the job completes, or for a maximum period of 7 days. When the job is complete, the NodeManager requests the NameNode to cancel the delegation token.

Token Format

The NameNode uses a random masterKey to generate delegation tokens. All active tokens are stored in memory with their expiry date (maxDate). Delegation tokens can either expire when the current time exceeds the expiry date, or, they can be canceled by the owner of the token. Expired or canceled tokens are then deleted from memory. The sequenceNumber serves as a unique ID for the tokens. The following section describes how the Delegation Token is used for authentication.

```
TokenID = {ownerID, renewerID, issueDate, maxDate, sequenceNumber}  
TokenAuthenticator = HMAC-SHA1(masterKey, TokenID)  
Delegation Token = {TokenID, TokenAuthenticator}
```

Authentication Process

To begin the authentication process, the client first sends the TokenID to the NameNode. The NameNode uses this TokenID and the masterKey to once again generate the corresponding TokenAuthenticator, and consequently, the Delegation Token. If the NameNode finds that the token already exists in memory, and that the current time is less than the expiry date (maxDate) of the token, then the token is considered valid. If valid, the client and the NameNode will then authenticate each other by using the TokenAuthenticator that they possess as the secret key, and MD5 as the protocol. Since the client and NameNode do not actually exchange TokenAuthenticators during the process, even if authentication fails, the tokens are not compromised.

Token Renewal

Delegation tokens must be renewed periodically by the designated renewer (renewerID). For example, if a NodeManager is the designated renewer, the NodeManager will first authenticate itself to the NameNode. It will

then send the token to be authenticated to the NameNode. The NameNode verifies the following information before renewing the token:

- The NodeManager requesting renewal is the same as the one identified in the token by renewerID.
- The TokenAuthenticator generated by the NameNode using the TokenID and the masterKey matches the one previously stored by the NameNode.
- The current time must be less than the time specified by maxDate.

If the token renewal request is successful, the NameNode sets the new expiry date to $\min(\text{current time} + \text{renew period}, \text{maxDate})$. If the NameNode was restarted at any time, it will have lost all previous tokens from memory. In this case, the token will be saved to memory once again, this time with a new expiry date. Hence, designated renewers must renew all tokens with the NameNode after a restart, and before relaunching any failed tasks.

A designated renewer can also revive an expired or canceled token as long as the current time does not exceed maxDate. The NameNode cannot tell the difference between a token that was canceled, or has expired, and one that was erased from memory due to a restart, since only the masterKey persists in memory. The masterKey must be updated regularly.

Kerberos Configuration Strategies for CDP

An overview of integration options when configuring Kerberos for Cloudera Data Platform (CDP).

Table 1: Kerberos Configuration Strategies for CDP

	A. Direct integration of Cloudera Manager with AD/MIT/IPA KDC	B. Keytab retrieval through "keytab retrieval script"	C. Manual deployment / configuration of keytab for services
Brief description of functionality	Cloudera Manager can create/delete service principals directly in the KDC as needed, and Cloudera Manager will retrieve the keytabs for the created principals automatically.	Cloudera Manager will call an external script to retrieve a keytab for a given principal.	Cloudera Manager will maintain keytab/kerberos related configuration for services with either the A or B column methods, but we will override the default location of the keytab with a "Safety Valve" option.
Example	<p>This is the default/recommended setup.</p> <ul style="list-style-type: none"> • Cloudera Manager will store/track the available keytabs, and can create missing principals/keytabs after new services/role instances are added. • Cloudera Manager can recreate existing principals / keytabs if needed for some reason. 	<ul style="list-style-type: none"> • Where direct integration with AD / KDC is not feasible due to internal restrictions/policy. • Could be used integrate Cloudera Manager with unsupported KDC types. 	Could be used where customizations are needed to the keytabs due to external factors.
Principal naming convention	<p>Kerberos principals used by CDP are following this naming convention: service/fqdn@REALM.</p> <p>Most services use a single username across the cluster (like "hdfs" or "hive") for all roles of the service. The host part will vary based on the available hosts in the cluster, so a single service will likely need multiple principals, where the username part is the same, and the hostname will match one of the hosts where this service is running on. The default usernames used by the services can be found in "Hadoop Users (user:group) and Kerberos Principals".</p>		

	A. Direct integration of Cloudera Manager with AD/MIT/IPA KDC	B. Keytab retrieval through “keytab retrieval script”	C. Manual deployment / configuration of keytab for services
Scripts involved	<p>Cloudera Manager invokes these external shell scripts to perform credential management:</p> <p>Base directory: /opt/cloudera/cm/bin</p> <p>delete_credentials_ad.sh</p> <p>delete_credentials_ipa.sh</p> <p>delete_credentials.sh</p> <p>gen_credentials_ad.sh</p> <p>gen_credentials_ipa.sh</p> <p>gen_credentials.sh</p> <p>import_credentials_ipa.sh</p> <p>import_credentials.sh</p> <p>merge_credentials.sh</p>	<p>The “custom keytab retrieval script” will get a single principal name matching the above naming convention, and it should write the matching keytab to a directory also passed as an option to the script.</p> <p>There is a basic sample script provided in “Using a custom Kerberos keytab retrieval scrip”.</p>	None
Persistent storage of keytabs	Keytabs that are successfully retrieved will be stored in the Cloudera Manager-backed database to be deployed and used on demand.		None. Required keytabs should be stored on the hosts manually.
On-demand keytab merging	<p>In case a service (role instance) requires multiple principals for operation, Cloudera Manager will merge the individual keytabs into a single combined keytab automatically.</p> <p>For example: HDFS namenode uses both the “hdfs” and “HTTP” principal for operation. Cloudera Manager will create a merged keytab that contains both these principals.</p>		None. In case a service (role instance) requires multiple principals for operation, keytabs provided for the services (role instance) are needed to be merged manually.
On-demand keytab deployment	Cloudera Manager will automatically deploy the required configuration and keytab files into the process directory of the given role instance through the Cloudera Manager Agent when starting a service/role instance.		None. All required keytabs will need to be present on the host(s) for a service before starting it. Cloudera Manager should be used to configure the location of these keytab files though.
Keytab filename	<p>The keytab file & filename will be managed by Cloudera Manager. The keytab file will be deployed by the Cloudera Manager agent to the services process folder automatically.</p> <p>The filenames used by Cloudera Manager can be found in “Hadoop Users (user:group) and Kerberos Principals”.</p>		The name & location of the keytab file has to be specified manually, so it can be anything allowed by POSIX conventions.
Keytab file ownership and permissions	<p>The “System User” of the respective service needs read-write access for the keytab file. Cloudera Manager will set the proper owner/group on the file with permission mode 600 (read-write for owner, no access for group/others)</p> <p>Default owner/group and permissions can also be found in “Hadoop Users (user:group) and Kerberos Principals”.</p>		The “System User” of the respective service needs read-write access for the keytab file. The proper permission and ownership of the file needs to be set manually.

Related Information

[Hadoop Users \(user:group\) and Kerberos Principals](#)

[Using a custom Kerberos keytab retrieval script](#)

Configuring Authentication in Cloudera Manager

Overview of configuring Cloudera authentication.

Cloudera clusters can be configured to use Kerberos for authentication using a manual configuration process or by using the configuration wizard available from the Cloudera Manager Admin Console. Cloudera recommends using the wizard because it automates many of the configuration and deployment tasks. In addition, enabling Kerberos the cluster using the wizard also enables Kerberos authentication for all CDP components set up on the cluster.



Warning: Before enabling Kerberos authentication, configure Cloudera Manager for TLS/SSL. Failure to do so results in Kerberos keytabs being transferred over the network unencrypted.

Cloudera Manager Kerberos Wizard Overview

The Cloudera Manager Kerberos wizard starts by verifying various details of the Kerberos instance that will be used by the cluster. Before using the wizard, be sure to gather all the details about the Kerberos service or engage the Kerberos administrator for help during this process. There are many details of the Kerberos instance, and you will need to enter them in the wizard pages.

The wizard requires a working KDC, either an MIT KDC, a FreeIPA server, or an Active Directory KDC. Make sure that the KDC is set up and working prior to starting the wizard. Administrator-level privileges to the Kerberos instance are required to complete the prompts of the wizard. If you do not have access to credentials with these privileges, the Kerberos administrator will need to assist you.

Given the information provided to the wizard entry screens, the configuration wizard does the following:

- Configures the necessary properties in all configuration files—core-site.xml, hdfs-site.xml, mapred-site.xml, and taskcontroller.cfg—to set Kerberos as the authentication mechanism for the cluster
- Configures the necessary properties in the oozie-site.xml and hue.ini files for Oozie and Hue for Kerberos authentication
- Creates principal and keytab files for core system users, such as hdfs and mapred, and for CDP services
- Distributes the keytab files to each host in the cluster
- Creates keytab files for oozie and hue users and deploys to the appropriate hosts that support these client-focused services
- Distributes a configured krb5.conf to all nodes in the cluster
- Stops all services
- Deploys client configurations
- Restarts all services throughout the cluster

Keytab file for...	Principals
hdfs	hdfs, host
mapred	mapred, host
oozie	oozie, HTTP
hue	hue

The host principal is the same in both hdfs and mapred keytab files.

After making the configuration changes and deploying the keytabs, and configuration files to the appropriate nodes in the cluster, Cloudera Manager starts all services to stand up the cluster.

- To use the Kerberos configuration wizard, see “Enabling Kerberos Authentication for CDP”.
- To configure Kerberos authentication manually, see “How to Configure Clusters to Use Kerberos for Authentication”.

Related Information

[Enabling Kerberos Authentication for CDP](#)

[How to Configure Clusters to Use Kerberos for Authentication](#)

Cloudera Manager user accounts

Access to Cloudera Manager features is controlled by user accounts. A user account identifies how a user is authenticated and determines what privileges are granted to the user.

Minimum Required Role: [User Administrator](#) (also provided by Full Administrator) This feature is not available when using Cloudera Manager to manage Data Hub clusters.

When you are logged in to the Cloudera Manager Admin Console, the username you are logged in as is located at the far right of the top navigation bar.

A user with the User Administrator or Full Administrator role manages user accounts through the AdministrationUsers page. View active user sessions on the User Sessions tab.

User Authentication

Cloudera Manager provides several mechanisms for authenticating users. You can configure Cloudera Manager to authenticate users against the Cloudera Manager database or against an external authentication service. The external authentication service can be an LDAP server (Active Directory or an OpenLDAP compatible directory), or you can specify another external service. Cloudera Manager also supports using the Security Assertion Markup Language (SAML) to enable single sign-on.

If you are using LDAP or another external service, you can configure Cloudera Manager so that it can use both methods of authentication (internal database and external service), and you can determine the order in which it performs these searches. If you select an external authentication mechanism, Full Administrator users can always authenticate against the Cloudera Manager database. This prevents locking everyone out if the authentication settings are misconfigured, such as with a bad LDAP URL.

With external authentication, you can restrict login access to members of specific groups, and can specify groups whose members are automatically given Full Administrator access to Cloudera Manager.

Users accounts in the Cloudera Manager database page show Cloudera Manager in the User Type column. User accounts in an LDAP directory or other external authentication mechanism show External in the User Type column.

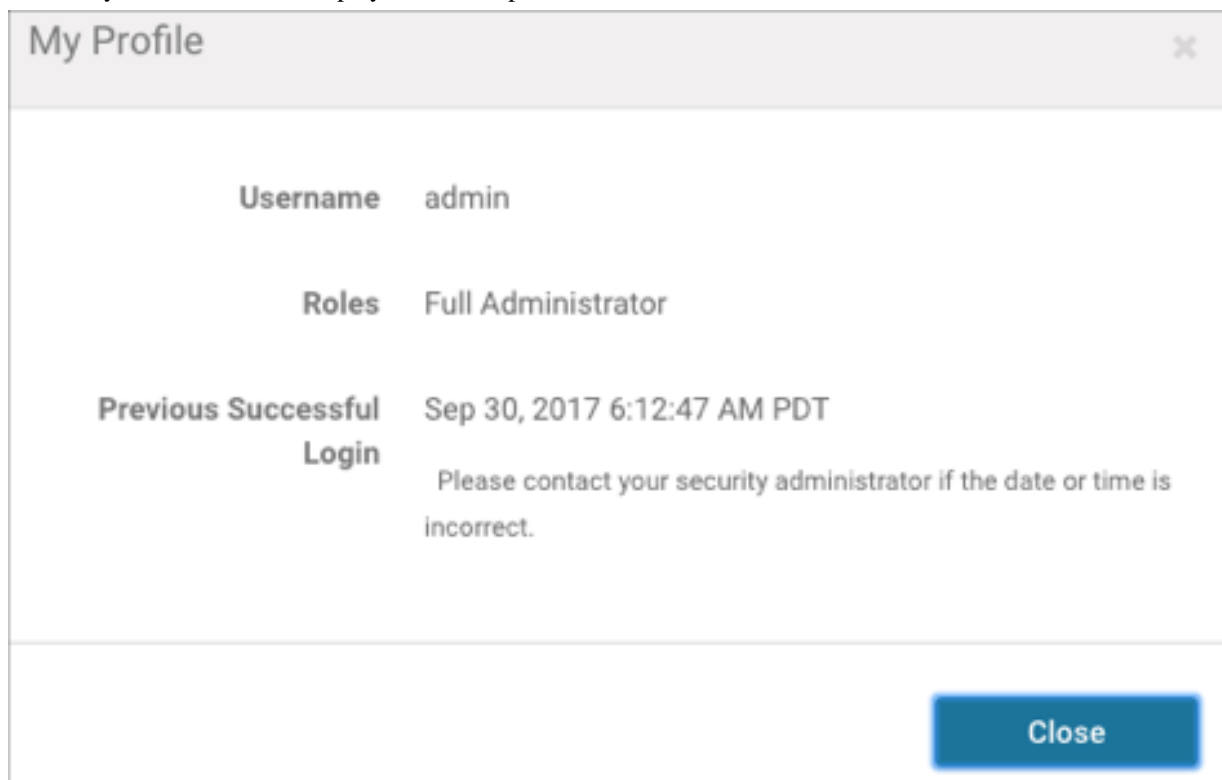
User Roles

User accounts include the user's role, which determines the Cloudera Manager features visible to the user, the actions the user can perform, and, for certain roles, what clusters actions can be performed on. All tasks in the Cloudera Manager documentation indicate which role is required to perform the task.

Determining the Role of the Currently Logged in User

1. Click the logged-in username at the far right of the top navigation bar.

2. Select My Profile. The role displays. For example:



Changing the Logged-In Internal User Password

1. Click the logged-in username at the far right of the top navigation bar and select Change Password.
2. Enter the current password and a new password twice, and then click OK.

Adding an Internal User Account

1. Select AdministrationUsers.
2. Click the Add User button.
3. Enter a username and password.
4. In the Role drop-down menu, select a role for the new user.
5. Click Add.

Assigning User Roles

1. Select AdministrationUsers.
2. Check the checkbox next to one or more usernames.
3. Select Actions for SelectedAssign User Roles.
4. In the drop-down menu, select the role.
5. Click the Assign Role button.

Changing an Internal User Account Password

1. Select AdministrationUsers.
2. Click the Change Password button next to a username with User Type Cloudera Manager.
3. Type the new password and repeat it to confirm.
4. Click the Update button to make the change.

Deleting Internal User Accounts

1. Select AdministrationUsers.
2. Check the checkbox next to one or more usernames with User Type Cloudera Manager.
3. Select Actions for SelectedDelete.
4. Click the OK button. (There is no confirmation of the action.)

Viewing User Sessions

1. Select AdministrationUsers.
2. Click the tab User Sessions.

Configuring external authentication and authorization for Cloudera Manager

Cloudera Manager supports user authentication against an internal database and against an external service. The following sections describe how to configure the supported external services.

Configuring PAM authentication with LDAP and SSSD

You can configure PAM authentication with one or more Active Directory/LDAP servers using System Security Services Daemon (SSSD). SSSD is a system service that allows the Cloudera Manager Server host to access a remote LDAP directory or Active Directory domain.

About this task

For more information on SSSD, see Red Hat documentation.

Procedure

1. Configure SSSD on the Cloudera Manager server host. Run the following command to check if the remote user has been synchronized to the server host:
`id <remote_username>`
2. In Cloudera Manager, click AdministrationSettingsExternal Authentication.
3. Verify that the Authentication Backend Order property is not set to "Database Only."
4. Verify that the Authorization Backend Order property is not set to "Database Only." If set to Database Only, the external group mapping will not work.
5. Select PAM as the external authentication type.
6. If you have a specific PAM configuration you wish to use for Cloudera Manager, modify the PAM Service Name property with that configuration's name (it should correspond to a file residing in /etc/pam.d/). Otherwise, use the default value, login.
7. Save the changes.
8. Add your group mapping roles. Click AdministrationUsers & RolesLDAP/PAM Groups, then Add LDAP/PAM Group Mapping.
9. When finished, restart the Cloudera Manager Server:
`sudo systemctl restart cloudera-scm-server`

Configuring PAM authentication with Linux users

You can configure PAM authentication to allow built-in Linux users to log in to Cloudera Manager.

Procedure

1. Configure the Cloudera Manager Server host:

- a) The Linux user who is running Cloudera Manager (for example, cloudera-scm) must have read access to the system shadow file. Run the following command on the Cloudera Manager Server host to check the shadow file group permission::

```
ls -l /etc/shadow
-----r-----+ 1 root root 1738 Jul 16 17:09 /etc/shadow
```

The above example shows that the root group of the shadow file is the owner group and not the shadow group. The 'r' indicates that the user in the root group can have read access to the shadow file.

If you see something like ----- 1 root root 1611 Jul 16 17:09 /etc/shadow, no group read permission is assigned. Add that permission to the file by running the following command:

```
chmod g+r /etc/shadow
```

2. Add the user to the owner group:

```
usermod -a -G root cloudera-scm
```

If the owner group is the shadow group:

```
usermod -a -G shadow cloudera-scm
```

3. In Cloudera Manager, click AdministrationSettingsExternal Authentication.
4. Verify that the Authentication Backend Order property is not set to "Database Only."
5. Verify that the Authorization Backend Order property is not set to "Database Only." If set to Database Only, the external group mapping will not work.
6. Select PAM as the external authentication type.
7. If you have a specific PAM configuration you wish to use for Cloudera Manager, modify the PAM Service Name property with that configuration's name (it should correspond to a file residing in /etc/pam.d/). Otherwise, use the default value, login.
8. Save the changes.
9. When finished, restart the Cloudera Manager Server:

```
sudo systemctl restart cloudera-scm-server
```
10. To test the configuration, log into Cloudera Manager with a Linux user and run the following commands in the host server console to create a user and assign groups to the user:
 - a) Create the user:

```
useradd testUser
passwd testUser
```

- b) Assign groups to the user:

```
groupadd testGroup
usermod -a -G testGroup testUser
```

11. In Cloudera Manager, map roles to the groups that your user belongs to. Click AdministrationUsers & RolesLDAP/PAM Groups, then Add LDAP/PAM Group Mapping.

Results

You can now login to Cloudera Manager using the Linux user you just created.

Configuring PAM authentication using Apache Knox

You can configure Cloudera Manager to authenticate through Apache Knox, with authorization provided by LDAP through PAM.

Procedure

1. In Cloudera Manager, click AdministrationSettingsExternal Authentication.
2. Search for the property Enable SPNEGO/Kerberos Authentication for the Admin Console and API, and select the checkbox to enable it.
3. Search for "Knox Proxy" to view the Knox properties that you need to configure.
4. Set the Allowed Groups for Knox Proxy property to the appropriate LDAP group values.
5. Set the Allowed Users for Knox Proxy property to the appropriate users.
6. Set the Allowed Hosts for Knox Proxy property to the appropriate host values (IP address or FQDN).
7. Cloudera Manager checks whether PUT/POST requests come from the same referers. To relax that restriction, set the Cloudera Manager Frontend URL property (AdministrationSettings) to the Knox host and port (for example, "https://bsmith-knox2-1.bsmith-knox2.root.hwx.site:8443").
8. Verify that the Authorization Backend Order property is not set to "Database Only." If set to Database Only, the external group mapping will not work.
9. Restart the Cloudera Manager Server:

```
sudo systemctl restart cloudera-scm-server
```
10. In Cloudera Manager, map roles to the groups that your user belongs to. Click AdministrationUsers & RolesLDAP/PAM Groups, then Add LDAP/PAM Group Mapping.

Configure authentication using Active Directory

How to configure authentication using Active Directory in Cloudera Manager.

Procedure

1. Log in to the Cloudera Manager Admin Console.
2. Select Administration Settings
3. Select External Authentication in the Category filter.
4. For Authentication Backend Order, select the order in which Cloudera Manager should look up authentication credentials for login attempts.
5. For External Authentication Type, select Active Directory.
6. In the LDAP URL property, enter the URL of the Active Directory server.
7. In the Active Directory Domain property, provide the domain to authenticate against.

LDAP URL and Active Directory are the only settings required to allow anyone in Active Directory to log in to Cloudera Manager.

For example, if you set LDAP URL to `ldap://adserver.example.com` and the Active Directory Domain to `ADREALM.EXAMPLE.COM`, users can log into Cloudera Manager using just their username, such as `sampleuser`. They no longer require the complete string: `sampleuser@ADREALM.EXAMPLE.COM`.

8. Restart the Cloudera Manager Server.

Configure authentication using an LDAP-compliant identity service

How to configure authentication using LDAP in Cloudera Manager.

About this task

An LDAP-compliant identity/directory service, such as OpenLDAP, provides different options for enabling Cloudera Manager to look-up user accounts and groups in the directory:

- Use a single Distinguished Name (DN) as a base for matching user names in the directory, or
- Search filter options let you search for a particular user based on somewhat broader search criteria – for example Cloudera Manager users could be members of different groups or organizational units (OUs), so a single pattern

does not find all those users. Search filter options also let you find all the groups to which a user belongs, to help determine if that user should have login or admin access.



Note: The LDAP Distinguished Name Pattern property is deprecated. Leave this field empty while configuring authentication using LDAP in Cloudera Manager.

Procedure

1. Log in to Cloudera Manager Admin Console.
2. Select Administration Settings .
3. Select External Authentication for the Category filter to display the settings.
4. For Authentication Backend Order, select the order in which Cloudera Manager should look up authentication credentials for login attempts.
5. For External Authentication Type, select LDAP.
6. In the LDAP URL property, provide the URL of the LDAP server and (optionally) the base Distinguished Name (DN) (the search base) as part of the URL — for example `ldap://ldap-server.corp.com/dc=corp,dc=com`.
7. If your server does not allow anonymous binding, provide the user DN and password to be used to bind to the directory. These are the LDAP Bind User Distinguished Name and LDAP Bind Password properties. By default, Cloudera Manager assumes anonymous binding.
8. Search for users and groups. You can search using User or Group search filters, using the LDAP User Search Base, LDAP User Search Filter, LDAP Group Search Base and LDAP Group Search Filter settings. These allow you to combine a base DN with a search filter to allow a greater range of search targets.

For example, if you want to authenticate users who may be in one of multiple OUs, the search filter mechanism will allow this. You can specify the User Search Base DN as `dc=corp,dc=com` and the user search filter as `uid={0}`. Then Cloudera Manager will search for the user anywhere in the tree starting from the Base DN. Suppose you have two OUs—`ou=Engineering` and `ou=Operations`—Cloudera Manager will find User "foo" if it exists in either of these OUs, that is, `uid=foo,ou=Engineering,dc=corp,dc=com` or `uid=foo,ou=Operations,dc=corp,dc=com`.

The Groups filters let you search to determine if a DN or username is a member of a target group. In this case, the filter you provide can be something like `member={0}` where `{0}` will be replaced with the DN of the user you are authenticating. For a filter requiring the username, `{1}` may be used, as `memberUid={1}`. This will return a list of groups the user belongs to, which will be compared to the list in the group properties.

9. Save the configuration changes.
10. In Administration Users & Roles LDAP/PAM Groups , choose Test LDAP User.
You will be prompted to provide a username and password for an LDAP user in order to test whether that user can be authenticated.
11. Restart the Cloudera Manager Server.

Configuring Cloudera Manager to Use LDAPS

About this task

If the LDAP server certificate has been signed by a trusted Certificate Authority, steps 1 and 2 below may not be necessary.

Procedure

1. Copy the CA certificate file to the Cloudera Manager Server host.

2. Import the CA certificate(s) from the CA certificate file to the local truststore. The default truststore is located in the `$JAVA_HOME/jre/lib/security/cacerts` file.

This contains the default CA information shipped with the JDK. Create an alternate default file called `jssecacerts` in the same location as the `cacerts` file. You can now safely append CA certificates for any private or public CAs not present in the default `cacerts` file, while keeping the original file intact.

For our example, we will follow this recommendation by copying the default `cacerts` file into the new `jssecacerts` file, and then importing the CA certificate to this alternate truststore.

```
cp $JAVA_HOME/jre/lib/security/cacerts $JAVA_HOME/jre/lib/security/jssecacerts
```

```
$ /usr/java/latest/bin/keytool -import -alias nt_domain_name
-keystore /usr/java/latest/jre/lib/security/jssecacerts -f
file path_to_CA_cert
```



Note: The default password for the `cacerts` store is `changeit`. The `-alias` does not always need to be the domain name.

Alternatively, you can use the Java options: `javax.net.ssl.trustStore` and `javax.net.ssl.trustStorePassword`. Open the `/etc/default/cloudera-scm-server` file and add the following options:

```
export CMF_JAVA_OPTS="-Xmx2G -XX:MaxPermSize=256m -XX:+HeapDumpOnOutOfMemoryError
-XX:HeapDumpPath=/tmp -Djavax.net.ssl.trustStore=/usr/java/default/jre/lib/security/jssecacerts
-Djavax.net.ssl.trustStorePassword=changeit"
```

3. Configure the LDAP URL property to use `ldaps://ldap_server` instead of `ldap://ldap_server`
4. Restart the Cloudera Manager Server.

Configure authentication using Kerberos (SPNEGO)

Cloudera Manager 6.3 and higher support Kerberos authentication using SPNEGO for the Admin Console as well as the API.

Before you begin



Important:

With SPNEGO enabled, the Swagger-based Java and Python SDKs, as well as the older deprecated Java SDK, can still authenticate using HTTP Basic Authentication. The older deprecated Python SDK cannot. Do not enable SPNEGO if you are relying on the deprecated Python client for any operations.

Procedure

1. If you have not already done so, enable Kerberos for cluster services.
2. Navigate to Administration > Settings.
3. Enter SPNEGO in the Search field.
4. Select the Enable SPNEGO/Kerberos Authentication for the Admin Console and API checkbox. Leave the other SPNEGO settings blank to allow Cloudera Manager to automatically generate the principal and keytab.
5. Click Save Changes.
6. Restart Cloudera Manager Server.

Configure authentication using an external program

How to configure authentication using an external program in Cloudera Manager.

About this task

Cloudera Manager can use a custom external authentication program. Typically, this may be a custom script that interacts with a custom authentication service. Cloudera Manager will call the external program with the username as the first command line argument. The password is passed over stdin. Each positive value exit code can be mapped to Cloudera Manager user roles. A negative value is returned for failure to authenticate. Valid values for the exit code are between 0 and 127.

Procedure

1. Log in to Cloudera Manager Admin Console.
2. Select Administration Settings
3. Select External Authentication for the Category filter to display the settings.
4. For External Authentication Type, select External Program.
5. Provide a path to the external program in the External Authentication Program Path property.

What to do next

After you configure authentication for Cloudera Manager, configure authorization for the authenticated users. This is done by mapping the authenticated users to Cloudera Manager user roles.

Configure authentication using SAML

How to configure authentication using SAML in Cloudera Manager..

Before you begin

About this task

Cloudera Manager supports the Security Assertion Markup Language (SAML), an XML-based open standard data format for exchanging authentication and authorization data between parties, in particular, between an identity provider (IDP) and a service provider (SP). The SAML specification defines three roles: the principal (typically a user), the IDP, and the SP. In the use case addressed by SAML, the principal (user agent) requests a service from the service provider. The service provider requests and obtains an identity assertion from the IDP. On the basis of this assertion, the SP can make an access control decision—in other words it can decide whether to perform some service for the connected principal.

The primary SAML use case is called web browser single sign-on (SSO). A user wielding a user agent (usually a web browser) requests a web resource protected by a SAML SP. The SP, wanting to know the identity of the requesting user, issues an authentication request to a SAML IDP through the user agent. In the context of this terminology, Cloudera Manager operates as a SP. This topic discusses the Cloudera Manager part of the configuration process; it assumes that you are familiar with SAML and SAML configuration in a general sense, and that you have a functioning IDP already deployed.



Note:

- Cloudera Manager supports both SP- and IDP-initiated SSO.
- The logout action in Cloudera Manager will send a single-logout request to the IDP.
- SAML authentication has been tested with specific configurations of SiteMinder and Shibboleth. While SAML is a standard, there is a great deal of variability in configuration between different IDP products, so it is possible that other IDP implementations, or other configurations of SiteMinder and Shibboleth, may not interoperate with Cloudera Manager.
- To bypass SSO if SAML configuration is incorrect or not working, you can login using a Cloudera Manager local account using the URL: `http://cm_host:7180/cm/localhostLogin`

Prepare Files

About this task

You will need to prepare the following files and information, and provide these to Cloudera Manager:

- A Java keystore containing a private key for Cloudera Manager to use to sign/encrypt SAML messages.
- The SAML metadata XML file from your IDP. This file must contain the public certificates needed to verify the sign/encrypt key used by your IDP per the SAML Metadata Interoperability Profile. For example, if you are using the Shibboleth IdP, the metadata file is available at: <https://<IdPHOST>:8080/idp/shibboleth>.



Note: For guidance on how to obtain the metadata XML file from your IDP, either contact your IDP administrator or consult the documentation for the version of the IDP you are using.

- The entity ID that should be used to identify the Cloudera Manager instance
- How the user ID is passed in the SAML authentication response:
 - As an attribute. If so, what identifier is used.
 - As the NameID.
- The method by which the Cloudera Manager role will be established:
 - From an attribute in the authentication response:
 - What identifier will be used for the attribute
 - What values will be passed to indicate each role
 - From an external script that will be called for each use:
 - The script takes user ID as \$1
 - The script sets an exit code to reflect successful authentication. Valid values for the exit codes are between 0 and 127. These values are used in Cloudera Manager to map authenticated users to user roles within Cloudera Manager.

Configure Cloudera Manager

Procedure

1. Log in to Cloudera Manager Admin Console.
2. Select Administration Settings .
3. Select External Authentication for the Category filter to display the settings.
4. Set the External Authentication Type property to SAML (the Authentication Backend Order property is ignored for SAML).
5. Set the Path to SAML IDP Metadata File property to point to the IDP metadata file.
6. Set the Path to SAML Keystore File property to point to the Java keystore prepared earlier.
7. In the SAML Keystore Password property, set the keystore password.
8. In the Alias of SAML Sign/Encrypt Private Key property, set the alias used to identify the private key for Cloudera Manager to use.
9. In the SAML Sign/Encrypt Private Key Password property, set the private key password.
10. Set the SAML Entity ID property if:
 - There is more than one Cloudera Manager instance being used with the same IDP (each instance needs a different entity ID).
 - Entity IDs are assigned by organizational policy.
11. In the Source of User ID in SAML Response property, set whether the user ID will be obtained from an attribute or the NameID.

If an attribute will be used, set the attribute name in the SAML attribute identifier for user ID property. The default value is the normal OID used for user IDs and so may not need to be changed.

12. In the SAML Role assignment mechanism property, set whether the role assignment will be done from an attribute or an external script.
 - If an attribute will be used:
 - In the SAML attribute identifier for user role property, set the attribute name if necessary. The default value is the normal OID used for OrganizationalUnits and so may not need to be changed.
 - If an external script will be used, set the path to that script in the Path to SAML Role Assignment Script property. Make sure that the script is executable (an executable binary is fine - it does not need to be a shell script).
13. Save the changes. Cloudera Manager will run a set of validations that ensure it can find the metadata XML and the keystore, and that the passwords are correct. If you see a validation error, correct the problem before proceeding.
14. Restart the Cloudera Manager Server.

What to do next

After you configure authentication for Cloudera Manager, configure authorization for the authenticated users. This is done by mapping the authenticated users to Cloudera Manager user roles.

Configuring the IDP

About this task

After the Cloudera Manager Server is restarted, it will attempt to redirect to the IDP login page instead of showing the normal CM page. This may or may not succeed, depending on how the IDP is configured. In either case, the IDP will need to be configured to recognize CM before authentication will actually succeed. The details of this process are specific to each IDP implementation - refer to your IDP documentation for details.

Procedure

1. Download the Cloudera Manager's SAML metadata XML file from <http://hostname:7180/saml/metadata>.
2. Inspect the metadata file and ensure that any URLs contained in the file can be resolved by users' web browsers. The IDP will redirect web browsers to these URLs at various points in the process. If the browser cannot resolve them, authentication will fail. If the URLs are incorrect, you can manually fix the XML file or set the Entity Base URL in the CM configuration to the right value, and then re-download the file.
3. Provide this metadata file to your IDP using whatever mechanism your IDP provides.
4. Ensure that the IDP has access to whatever public certificates are necessary to validate the private key that was provided to Cloudera Manager earlier.
5. Ensure that the IDP is configured to provide the User ID and Role using the attribute names that Cloudera Manager was configured to expect, if relevant.
6. Ensure the changes to the IDP configuration have taken effect (a restart may be necessary).

Verifying Authentication and Authorization

Procedure

1. Return to the Cloudera Manager Admin Console and refresh the login page.
2. Attempt to log in with credentials for a user that is entitled. The authentication should complete and you should see the Home Status tab.
3. If authentication fails, you will see an IDP provided error message. Cloudera Manager is not involved in this part of the process, and you must ensure the IDP is working correctly to complete the authentication.
4. If authentication succeeds but the user is not authorized to use Cloudera Manager, they will be taken to an error page by Cloudera Manager that explains the situation. If an user who should be authorized sees this error, then you will need to verify their role configuration, and ensure that it is being properly communicated to Cloudera Manager, whether by attribute or external script. The Cloudera Manager log will provide details on failures

to establish a user's role. If any errors occur during role mapping, Cloudera Manager will assume the user is unauthorized.

Enabling Kerberos Authentication for CDP

How to use the Cloudera Manager Kerberos wizard to set up authentication.

Minimum Required Role: [Cluster Administrator](#) (also provided by Full Administrator) This feature is not available when using Cloudera Manager to manage Data Hub clusters.

Cloudera Manager provides a wizard for integrating your organization's Kerberos instance with your cluster to provide authentication services.

Kerberos must already be deployed in your organization and the Kerberos key distribution center (KDC) must be ready to use, with a realm established. If you are using Red Hat Identity Management/FreeIPA, all of your cluster hosts must already be joined to the IPA domain. For Hue and Oozie, the Kerberos realm must support renewable tickets.



Important: Before integrating Kerberos with your cluster, configure TLS encryption between Cloudera Manager Server and all Cloudera Manager Agent host systems in the cluster. During the Kerberos integration process, Cloudera Manager Server sends keytab files to the Cloudera Manager Agent hosts, and TLS encrypts the network communication so these files are protected.

Cloudera Manager clusters can be integrated with MIT Kerberos, Red Hat Identity Management (or the upstream FreeIPA), or Microsoft Active Directory.

For Active Directory, you must have administrative privileges to the Active Directory instance for initial setup and for on-going management, or you will need to have the help of your AD administrator prior to and during the integration process. For example, administrative access is needed to access the Active Directory KDC, create principals, and troubleshoot Kerberos TGT/TGS-ticket-renewal and take care of any other issues that may arise.

For Red Hat IdM, make sure that all cluster hosts are joined to the IPA domain. You can join a host to the domain by installing the freeipa-client package and then running the ipa-client-install script.

Kerberos client OS-specific packages must be installed on all cluster hosts and client hosts that will authenticate using Kerberos.

OS	Packages Required
RHEL 7 Compatible, RHEL 6 Compatible	<ul style="list-style-type: none"> • openldap-clients on the Cloudera Manager Server host • krb5-workstation, krb5-libs on ALL hosts • (Red Hat IdM/FreeIPA only) freeipa-client on all cluster hosts
SLES	<ul style="list-style-type: none"> • openldap2-client on the Cloudera Manager Server host • krb5-client on ALL hosts • (Red Hat IdM/FreeIPA only) freeipa-client on all cluster hosts
Ubuntu	<ul style="list-style-type: none"> • ldap-utils on the Cloudera Manager Server host • krb5-user on ALL hosts • (Red Hat IdM/FreeIPA only) freeipa-client on all cluster hosts

Cloudera supports the Kerberos version that ships with each supported operating system listed in “Operating System Requirements”.

Related Information

[Operating System Requirements](#)

Step 1: Install Cloudera Manager and CDP

Cloudera strongly recommends that you install and configure the Cloudera Manager Server and Cloudera Manager Agents and CDP to set up a fully-functional CDP cluster before trying to configure Kerberos authentication for the cluster.

Required user:group Settings for Security

About this task

When you install the CDP packages and the Cloudera Manager Agents on your cluster hosts, Cloudera Manager takes some steps to provide system security such as creating the OS user:group accounts and setting directory permissions as shown in the table below. These user accounts and directory permissions work with the Hadoop Kerberos security requirements.

This User	Runs These Roles
hdfs	NameNode, DataNodes, and Secondary NameNode
mapred	JobTracker and TaskTrackers (MR1) and Job History Server (YARN)
yarn	ResourceManager and NodeManagers (YARN)
oozie	Oozie Server
hue	Hue Server, Beeswax Server, Authorization Manager, and Job Designer

The hdfs user has HDFS superuser privileges.

When you install the Cloudera Manager Server on the server host, a new Unix user account called cloudera-scm is created automatically to support security. The Cloudera Manager Server uses this account to create host principals and deploy the keytabs on your cluster.

Depending on whether you installed CDP and Cloudera Manager at the same time or not, use one of the following sections for information on configuring directory ownerships on cluster hosts.

New Installation, Cloudera Manager and CDP Together

Installing a new Cloudera Manager cluster with CDP components at the same time can save you some of the user:group configuration required if you install them separately. The installation process creates the necessary user accounts on the Linux host system for the service daemons. At the end of the installation process when each cluster node starts up, the Cloudera Manager Agent process on the host automatically configures the directory ownership as shown in the table below, and the Hadoop daemons can then automatically set permissions for their respective directories. Do not change the directory owners on the cluster. They must be configured exactly as shown below.

Step 2: Install JCE policy files for AES-256 encryption

How to install JCE policy files, if required.

Before you begin



Note: This step is not required when using JDK 1.8.0_161 or greater. JDK 1.8.0_161 enables unlimited strength encryption by default.

By default, CentOS and Red Hat Enterprise Linux 5.5 (and higher) use AES-256 encryption for Kerberos tickets, so the Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy Files must be installed on all cluster hosts as detailed below. Alternatively, the Kerberos instance can be modified to not use AES-256.

To manually install the JCE policy files on the host system:

1. Download the jce_policy-<version>.zip file from the Oracle website.
2. Unzip the file.
3. Follow the steps in README.txt to install it.

To use Cloudera Manager to install the JCE policy file:

1. Log in to the Cloudera Manager Admin Console.
2. Navigate to AdministrationSecurity.
3. Click Install Java Unlimited Strength Encryption Policy Files.
4. Specify the repository location for your version of Cloudera Manager, and click Continue.

5. Check the box labeled Install Oracle Java SE Development Kit (JDK 8), and then check the box labeled Install Java Unlimited Strength Encryption Policy Files. Click Continue.
6. Provide cluster host login credentials, and then click Continue.
7. After the installation completes, click Finish. If the Upgrade Cloudera Manager page displays, you can exit by clicking the Cloudera Manager logo to return to the home page.

Alternative: Disable AES-256 encryption from the Kerberos instance:

1. Remove any aes256 entries from the supported_enctypes field of the kdc.conf or krb5.conf files.
2. Restart the Kerberos KDC and the kadmin server so the changes take effect.

The keys of relevant principals, such as Ticket Granting Ticket principal (krbtgt/REALM@REALM), might need to change.



Note: If AES-256 remains in use despite disabling it, it may be because the aes256-cts:normal setting existed when the Kerberos database was created. To resolve this issue, create a new Kerberos database and then restart both the KDC and the kadmin server.

To verify the type of encryption used in your cluster:

Procedure

1. For MIT KDC: On the local KDC host, type this command in the kadmin.local or kadmin shell to create a test principal:

```
kadmin: addprinc test
```

For Active Directory: Create a new AD account with the name, test.

2. On a cluster host, type this command to start a Kerberos session as test:

```
kinit test
```

3. On a cluster host, type this command to view the encryption type in use:

```
klist -e
```

If AES is being used, output like the following is displayed after you type the klist command (note that AES-256 is included in the output):

```
Ticket cache: FILE:/tmp/krb5cc_0
Default principal: test@Cloudera Manager
Valid starting Expires Service principal
05/19/11 13:25:04 05/20/11 13:25:04 krbtgt/Cloudera Manager@Cloudera Manager
Etype (skey, tkt): AES-256 CTS mode with 96-bit SHA-1 HMAC, AES-256
CTS mode with 96-bit SHA-1 HMAC
```

Step 3: Create the Kerberos Principal for Cloudera Manager Server

How to create a Kerberos principal for Cloudera Manager Server.

About this task

At the end of the integration process using the configuration wizard, Cloudera Manager Server will create host principals and deploy keytabs for all services configured on the cluster, which means that Cloudera Manager Server requires a principal that has privileges to create these other accounts.



Note: This task requires administrator privileges on the Kerberos instance. If you do not have administrator privileges, ask your Kerberos administrator to setup the principal and password for you. You will need to enter the principal name and password into the wizard later in the install process.

If an administrator principal to act on behalf of Cloudera Manager cannot be created on the Kerberos KDC for whatever reason, Cloudera Manager cannot create or manage principals and keytabs for CDP services. That means these principals must be created manually on the Kerberos KDC and then imported (retrieved) by Cloudera Manager. See “Using a custom Kerberos keytab retrieval script” for details about this process.



Note: The steps below summarize the process of adding a principal specifically for Cloudera Manager Server to an MIT KDC and an Active Directory KDC. See documentation from MIT, Microsoft, or the appropriate vendor for more detailed information.

Related Information

[Using a custom Kerberos keytab retrieval script](#)

Creating a Principal in Active Directory

About this task

Check the Microsoft documentation for specific details for your Active Directory KDC. The general process is as follows:

Procedure

1. Create an Organizational Unit (OU) in your Active Directory KDC service that will contain the principals for use by the CDP cluster.
2. Add a new user account to Active Directory, for example, *username@EXAMPLE.COM*. Set the password for the user to never expire.
3. Use the Delegate Control wizard in Active Directory to grant this new user permission to Create, Delete, and Manage User Accounts in the OU created in step 1. Make sure that these permissions are only applied to that specific OU, and nowhere else.

Creating a Principal in an MIT KDC

About this task

For MIT Kerberos, administrator principals are defined in the `/var/kerberos/krb5kdc/kadm5.acl` file on the KDC host. The default entry is:

```
*/admin@EXAMPLE.COM      *
```

In this example, principals that include the instance name `admin` designate a user account as an administrator, such as `jdoe/admin@EXAMPLE.COM`.

If you modify the `kadm5.acl` file, such as replacing `EXAMPLE.COM` with your realm name, make sure to restart the `kadmin` service:

- RHEL 7 Compatible:

```
systemctl restart kadmin
```

- All Others:

```
service kadmin restart
```

Create the Cloudera Manager Server administrator principal as shown below, using the `admin` instance name and your realm name. If your `kadm5.acl` file defines a different pattern for administrators, make sure that the principal you create matches that pattern.

For MIT Kerberos KDC on a remote host:



Note: To connect to a remote KDC using the `kadmin` command, your currently authenticated Kerberos principal must be an existing Kerberos administrator. If you do not have an existing admin principal, you must run `kadmin.local` as described below.

```
kadmin
kadmin: addprinc -pw password cloudera-scm/admin@EXAMPLE.COM
```

For MIT Kerberos KDC on the local host:



Note: The `kadmin.local` command must be run as root on the same host as the KDC.

```
kadmin.local
kadmin.local: addprinc -pw password cloudera-scm/admin@EXAMPLE.COM
```

Creating a Principal in Red Hat Identity Management (FreeIPA)

About this task

If you are using Red Hat IdM or FreeIPA, the wizard creates its own user account with the necessary privileges. To do so, it requires admin credentials the first time. These admin credentials are not stored, and are used only to create a new user and role (named `cmadin-<random_id>` and `cmadminrole`, respectively) and retrieve its keytab. Cloudera Manager stores this keytab for future Kerberos operations, such as regenerating the credentials of the CDP service accounts.

Because the wizard creates the principal it requires, you do not need to manually create an admin principal for Cloudera Manager at this time.

For additional information, refer to the Red Hat documentation:

- RHEL 7: “Linux Domain Identity, Authentication, and Policy Guide”
- RHEL 6: “Identity Management Guide”

Step 4: Enable Kerberos using the wizard

How to enable Kerberos using the Cloudera Manager wizard.

Related Information

[Step 3: Create the Kerberos Principal for Cloudera Manager Server](#)

[Customizing Kerberos principals](#)

1. Getting Started

Before you begin

- Set up a working KDC in Step 1 of the wizard as described below. Cloudera Manager supports authentication with MIT KDC, Active Directory, and Red Hat Identity Management/FreeIPA.
- Configure the KDC to allow renewable tickets with non-zero ticket lifetimes.

Active Directory allows renewable tickets with non-zero lifetimes by default. You can verify this by checking Domain Security Settings Account Policies Kerberos Policy in Active Directory.

For MIT KDC, make sure you have the following lines in the `kdc.conf`.

```
max_life = 1d
max_renewable_life = 7d
```

- If you are using Active Directory, make sure LDAP over TLS/SSL (LDAPS) is enabled for the Domain Controllers.
- Host names must be in lowercase. If you use uppercase letters in any host name, the cluster services will not start after enabling Kerberos.

- Create an account for Cloudera Manager that has the permissions to create other accounts in the KDC. This should have been completed as part of “Step 3: Create the Kerberos Principal for Cloudera Manager Server”.

**Important:**

If YARN Resource Manager HA has been enabled in a non-secure cluster, before enabling Kerberos you must clear the StateStore znode in ZooKeeper, as follows:

1. Go to the Cloudera Manager Admin Console home page, click to the right of the YARN service and select Stop.
2. When you see a Finished status, the service has stopped.
3. Go to the YARN service and select Actions Format State Store .
4. When the command completes, click Close.

**Note:**

Minimum Required Role: [Full Administrator](#). This feature is not available when using Cloudera Manager to manage Data Hub clusters.

Procedure

1. To start the Kerberos wizard, open the Cloudera Manager Admin Console, click the options menu for the applicable cluster, then click Enable Kerberos.

- After you open the Kerberos wizard, a Getting Started page appears. Select the applicable KDC type to display configuration steps for your specific type of KDC. When you have completed all of the configuration steps, select the I have completed all the above steps check box, then click Continue.

The screenshot shows the 'Enable Kerberos for Cluster 1' wizard in Cloudera Manager. The left sidebar contains a navigation menu with steps 1 through 8: 1. Getting Started (selected), 2. Enter KDC Information, 3. Manage krb5.conf, 4. Enter Account Credentials, 5. Command Details, 6. Configure Kerberos, 7. Command Details, and 8. Summary. The main content area is titled 'Getting Started' and includes an information box stating: 'This wizard walks you through the steps to configure Cloudera Manager and the cluster to use Kerberos for authentication. All services in the cluster, as well as the Cloudera Management Service, are restarted as part of the wizard.' Below this, it says 'Before using the wizard, ensure that you have performed the following steps:' followed by a list of instructions: 1. Read the documentation about enabling Kerberos. 2. Set up a working KDC (Key Distribution Center) and specify the KDC Type: MIT KDC, Active Directory (selected), or Red Hat IPA. 3. Configure the KDC to have non-zero ticket lifetime and renewal lifetime. 4. Configure the KDC to have an account that has permissions to create other accounts. 5. Install OpenLdap client libraries on the Cloudera Manager Server host if you want to use Active Directory. 6. Terminal commands for RHEL/CentOS, SUSE, and Ubuntu. At the bottom, there is a green box with a checkmark and the text 'I have completed all the above steps.' and buttons for 'Cancel', 'Back', and 'Continue'.

Enable Kerberos for Cluster 1

Getting Started

1 Getting Started
2 Enter KDC Information
3 Manage krb5.conf
4 Enter Account Credentials
5 Command Details
6 Configure Kerberos
7 Command Details
8 Summary

Getting Started

i This wizard walks you through the steps to configure Cloudera Manager and the cluster to use Kerberos for authentication. All services in the cluster, as well as the Cloudera Management Service, are restarted as part of the wizard.

Before using the wizard, ensure that you have performed the following steps:

1. Read the [documentation](#) about enabling Kerberos.
2. Set up a working KDC (Key Distribution Center) and specify the **KDC Type**:

KDC Type

☐ MIT KDC

☒ Active Directory

☐ Red Hat IPA

[Undo](#)

3. Configure the KDC to have **non-zero ticket lifetime and renewal lifetime**. Clusters will not work properly if tickets are not renewable.
4. Configure the KDC to have an account that has **permissions to create other accounts**.
5. Install OpenLdap client libraries on the **Cloudera Manager Server host** if you want to use Active Directory.
- 6.

```
# RHEL / CentOS
$ yum install openldap-clients krb5-workstation krb5-libs

# SUSE
$ zypper install openldap2-client krb5-client

# Ubuntu
$ apt-get install ldap-utils krb5-user
```

☒ ☒ I have completed all the above steps.

[Cancel](#) [Back](#) [Continue](#)

2. Enter KDC Information

About this task

Enter configuration information for the KDC you are using.

**Note:**

- If you have multiple Domain Controllers (in case of AD) or MIT KDC servers, only enter the name of any one of them in the KDC Server Host field. Cloudera Manager will use that server only for creating accounts. Do not use a round-robin DNS for KDCs in the krb5.conf file. If you choose to use Cloudera Manager to manage the krb5.conf file, you can specify the additional Domain Controllers using the Advanced Configuration Snippet (Safety Valve) for the Default Realm in krb5.conf property as explained below. Fault tolerance and load balancing can be achieved by specifying more than one (usually 2-3) KDCs, using their FQDNs or IP addresses. This, along with a kdc_timeout parameter of 3-5 seconds, allows all Kerberos clients (including Java GSS-API) to attempt communication with the next KDC in the event of a KDC failure.
- Make sure the entries for the Kerberos Encryption Types field matches what your KDC supports.
- If you are using an Active Directory KDC, you can configure Active Directory account properties such as objectClass and accountExpires directly from the Cloudera Manager UI. You can also enable Cloudera Manager to delete existing AD accounts so that new ones can be created when Kerberos credentials are being regenerated.
- To use AES encryption, make sure you have deployed JCE Unlimited Strength Policy File, which is automatically included in Open JDK 1.8 232 (provided by Cloudera at the time of install) and up, but may not be available on some of the earlier JDK 1.8 releases.

Procedure

- In the Active Directory KDC example below, we entered values for the Kerberos Security Realm, the KDC Server Host, and the Active Directory Suffix, and also selected the Active Directory Delete Accounts on Credential Regeneration check box.

- Click Continue to proceed.

3. Manage krb5.conf

About this task

You can use this page to specify whether or not Cloudera Manager deploys and manages the krb5.conf file on your cluster.

Procedure

- If you select the Manage krb5.conf through Cloudera Manager check box, you can use this page to configure the krb5.conf file properties. In particular, the safety valves on this page can be used to configure cross-realm authentication.

To configure multiple KDCs (as mentioned in the previous section), you can specify the additional Domain Controllers using the Advanced Configuration Snippet (Safety Valve) for the Default Realm in krb5.conf property box. For example:

```
kdc = kdc2.supportlab.cloudera.com
kdc = kdc3.supportlab.cloudera.com
kdc = kdcN.supportlab.cloudera.com
```

Enable Kerberos for Cluster 1

Manage krb5.conf

Specify the properties needed for generating the krb5.conf file for the cluster. You can use the Advanced Configuration Snippet to specify configuration of an advanced KDC setup; for example, with cross-realm authentication.

Manage krb5.conf through ☒ Cloudera Manager [Undo](#) [?](#)

Kerberos Ticket Lifetime day(s) [?](#)
ticket_lifetime

Kerberos Renewable Lifetime day(s) [?](#)
renew_lifetime

DNS Lookup KDC ☐ [?](#)
dns_lookup_kdc

Forwardable Tickets ☒ [?](#)
forwardable

KDC Timeout second(s) [?](#)
kdc_timeout

Advanced Configuration Snippet (Safety Valve) for [libdefaults] section of krb5.conf [?](#)

Advanced Configuration Snippet (Safety Valve) for the Default Realm in krb5.conf [?](#)

Advanced Configuration Snippet (Safety Valve) for remaining krb5.conf [?](#)

Cancel [← Back](#) [Continue →](#)

CLUSTER

Getting Started
Enter KDC Information
3 Manage krb5.conf
4 Enter Account Credentials
5 Command Details
6 Configure Kerberos
7 Command Details
8 Summary

CDEP Deployment from 2019-Nov-14 09:20

Parcels
Recent Commands
Support
admin

- If left unchecked, you must ensure that the `krb5.conf` is deployed on all hosts in the cluster, including the Cloudera Manager Server host.

**Note:**

If you are using Red Hat IdM/FreeIPA, by default the `krb5.conf` file contains a line similar to the following:

```
default_ccache_name = KEYRING:persistent:%{uid}
```

CDP does not support the keyring credential cache. Comment out this line on every cluster host by adding a hash mark (#) at the beginning, like this:

```
#default_ccache_name = KEYRING:persistent:%{uid}
```

If you configure Cloudera Manager to manage the `krb5.conf` file, you do not need to do anything.

- Click Continue to proceed.

4. Enter Account Credentials

About this task



Note: Enter the REALM portion of the principal in upper-case only to conform to Kerberos convention.

**Note:**

Many enterprises employ policies that require all passwords to be changed after a particular number of days. you can use the following steps to change the password in Cloudera Manager for the Account Manager:

1. In the Cloudera Manager Admin Console, select Administration Security .
2. Go to the Kerberos Credentials tab and click Import Kerberos Account Manager Credentials.
3. In the Import Kerberos Account Manager Credentials dialog box, enter the user name and password for the user that can create principals for CDP cluster in the KDC.

Procedure

1. Enter the user name and password for the user that can create principals for CDP cluster in the KDC. This is the user/principal you created in “Step 3: Create the Kerberos Principal for Cloudera Manager Server”. Cloudera Manager encrypts the user name and password into a keytab and uses it as needed to create new principals.

If you are using Red Hat IdM/FreeIPA, enter the IPA admin credentials here. These admin credentials are not stored, and are used only to create a new user and role (named `cmadin-<random_id>` and `cmadminrole`,

respectively) and retrieve its keytab. Cloudera Manager stores this keytab for future Kerberos operations, such as regenerating the credentials of the CDP service accounts.

The screenshot shows the Cloudera Manager interface for enabling Kerberos on Cluster 1. The left sidebar contains the Cloudera Manager logo, a deployment timeline for CDEP from 2019-Nov-14 09:20, and navigation links for Parcels, Recent Commands, Support, and the user 'admin'. The main content area is titled 'Enable Kerberos for Cluster 1' and shows a progress bar with steps 1 through 8. Step 4, 'Enter Account Credentials', is the current step. The instructions state: 'Enter the credentials for the account that has permissions to create other users. Cloudera Manager will store the credentials in encrypted form and use them whenever new principals need to be generated.' The form has two fields: 'Username' with a value 'c...@AD.I...COM' and 'Password' with masked characters. At the bottom are 'Cancel', 'Back', and 'Continue' buttons.

2. Click Continue to proceed.

5. Command Details

Procedure

- The Command Details page displays the outcome of the Enter Account Credentials step. Click Continue to proceed.

The screenshot shows the 'Command Details' step of the 'Enable Kerberos for Cluster 1' wizard. The progress bar now highlights step 5. The main content area is titled 'Import KDC Account Manager Credentials Command'. It displays the status as 'Finished' with a green checkmark, the timestamp 'Nov 17, 10:56:03 AM', and a duration of '5.02s'. Below this, it states 'Successfully imported KDC Account Manager credentials.' The 'Back' and 'Continue' buttons are visible at the bottom.

6. Configure Kerberos

Procedure

1. If you have not already done so, run the provided commands on each cluster host to install the Kerberos client libraries.

Enable Kerberos for Cluster 1

Configure Kerberos

Install Kerberos client libraries on all hosts before proceeding.

```
# RHEL / CentOS
$ yum install krb5-workstation krb5-libs

# if Red Hat IPA is used as the KDC
$ yum install freeipa-client
```

```
# SUSE
$ zypper install krb5-client

# if Red Hat IPA is used as the KDC
$ zypper install freeipa-client
```

```
# Ubuntu
$ apt-get install krb5-user

# if Red Hat IPA is used as the KDC
$ apt-get install freeipa-client
```

Configure the privileged ports required by DataNodes in a secure HDFS service.

DataNode Transceiver Port: 1004
Port for DataNode's XCeiver Protocol. Combined with the DataNode's hostname to build its address.

DataNode HTTP Web UI Port: 1006
Port for the DataNode HTTP web UI. Combined with the DataNode's hostname to build its HTTP address.

Configure Kerberos Principals

☒ Use Default Kerberos Principals

Cancel Back Continue

2. The wizard automatically sets the privileged ports needed by the DataNode Transceiver Protocol and the HTTP Web UI, but you can also specify alternate privileged ports.



Note: If SSL is enabled, the assigned port numbers will be higher than 1024; if SSL is not enabled, the assigned port numbers will be less than 1024.

3. To configure custom service principals, clear the Use Default Kerberos Principals check box, and then specify a custom principal for each service.



Note: Before configuring custom service principals, see “Customizing Kerberos principals” for additional information.

4. Click Continue to proceed.

7. Command Details

Procedure

- The Command Details page displays the outcome of the Enable Kerberos command. It may take a few minutes for these steps to complete.

If an error message appears, you can fix the error, then click Resume. In the following example, we select Administration > Settings > Kerberos, then enter an invalid file name in the Custom Kerberos Keytab Retrieval Script box.

The screenshot shows the Cloudera Manager interface. On the left is a dark sidebar with the 'Administration' menu item selected. The main content area displays the 'Kerberos' configuration page. The 'Custom Kerberos Keytab Retrieval Script' field is highlighted with a red rectangular box and contains the text '/tmp/1.sh'. Other visible settings include 'Kerberos Ticket Lifetime' (1 day), 'Kerberos Renewable Lifetime' (7 days), 'DNS Lookup KDC' (unchecked), 'Forwardable Tickets' (checked), 'KDC Timeout' (3 seconds), 'Maximum Renewable Life for Principals' (5 days), 'Active Directory Domain Controller Override' (empty), and two 'Advanced Configuration Snippet (Safety Valve)' text areas for 'krb5.conf'.

This causes a credential generation error. In this case we can remove the invalid script setting, then click Resume to resume the Enable Kerberos command.

Getting Started

Enter KDC Information

Manage krb5.conf

Enter Account Credentials

Command Details

Configure Kerberos

Command Details

Summary

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Enable Kerberos for Cluster 1

Enable Kerberos Command

Investigate the failure step and once the cause is fixed, click Resume to continue

Status **Failed** Context [Cluster 1](#) Nov 21, 10:10:42 AM 99.85s [Resume](#)

Failed to enable Kerberos.

Completed 5 of 8 step(s).

☐ Show All Steps
 ☒ Show Only Failed Steps
 ☐ Show Only Running Steps

<div>Wait for credentials to be generated</div> <div>Command (Generate Missing Credentials (363)) has failed</div>	Nov 21, 10:12:08 AM	13.39s
<div>Execute global command Generate Missing Credentials</div> <div>Custom keytab retrieval script '/tmp/1.sh' is not an executable file.</div>	Nov 21, 10:12:16 AM	5.52s

[Cancel](#)
[Back](#)
[Continue](#)

After the command finishes running, click Continue to proceed.

Getting Started

Enter KDC Information

Manage krb5.conf

Enter Account Credentials

Command Details

Configure Kerberos

Command Details

Summary

CDEP Deployment from 2019-Nov-14 09:20

Parcels

Recent Commands

Support

admin

Enable Kerberos for Cluster 1

Enable Kerberos Command

Status **Finished** Context [Cluster 1](#) Nov 17, 12:06:51 PM 6.5m

Successfully enabled Kerberos.

Completed 8 of 8 step(s).

☒ Show All Steps
 ☐ Show Only Failed Steps
 ☐ Show Only Running Steps

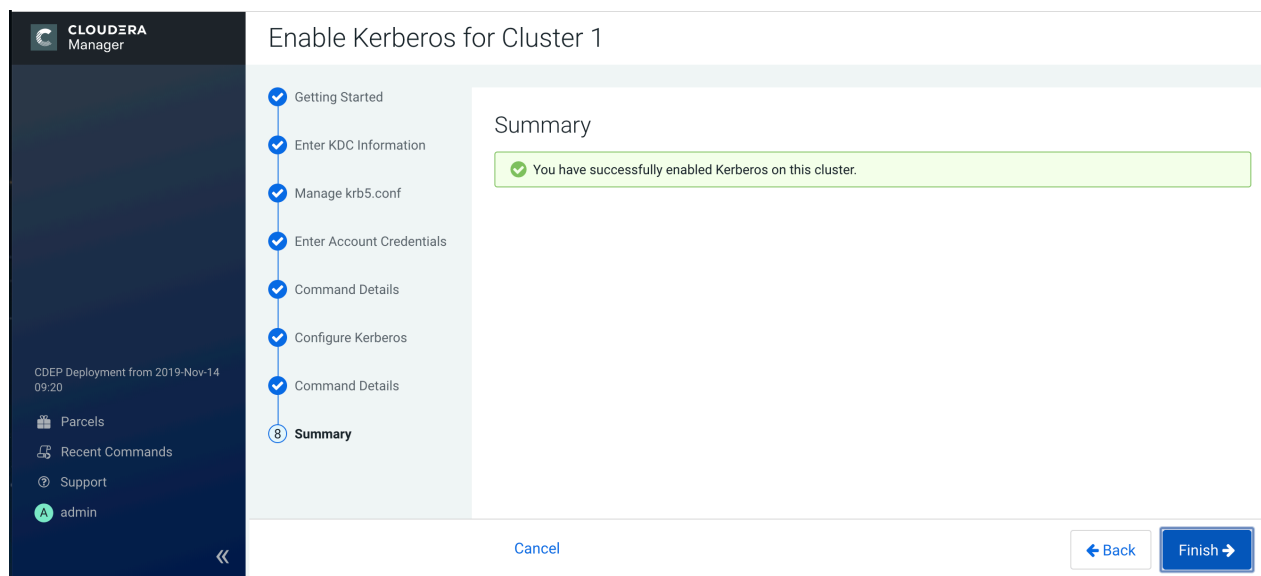
Stop cluster	Cluster 1	Nov 17, 12:06:52 PM	63.9s
Stop Cloudera Management Services	Cloudera Management Service	Nov 17, 12:07:56 PM	5.94s
Deploy krb5.conf	Cluster 1	Nov 17, 12:08:02 PM	15.27s
Configure all services to use Kerberos	Cluster 1	Nov 17, 12:08:17 PM	29ms
Wait for credentials to be generated		Nov 17, 12:08:17 PM	36.49s
Deploy client configuration	Cluster 1	Nov 17, 12:08:54 PM	20.98s
Start Cloudera Management Services	Cloudera Management Service	Nov 17, 12:09:15 PM	27.63s
Start cluster	Cluster 1	Nov 17, 12:09:46 PM	3.5m

[Cancel](#)
[Back](#)
[Continue](#)

8. Summary

About this task

The final step of the wizard lists the cluster(s) for which Kerberos has been successfully enabled. Click Finish to return to the Cloudera Manager Admin Console home page.

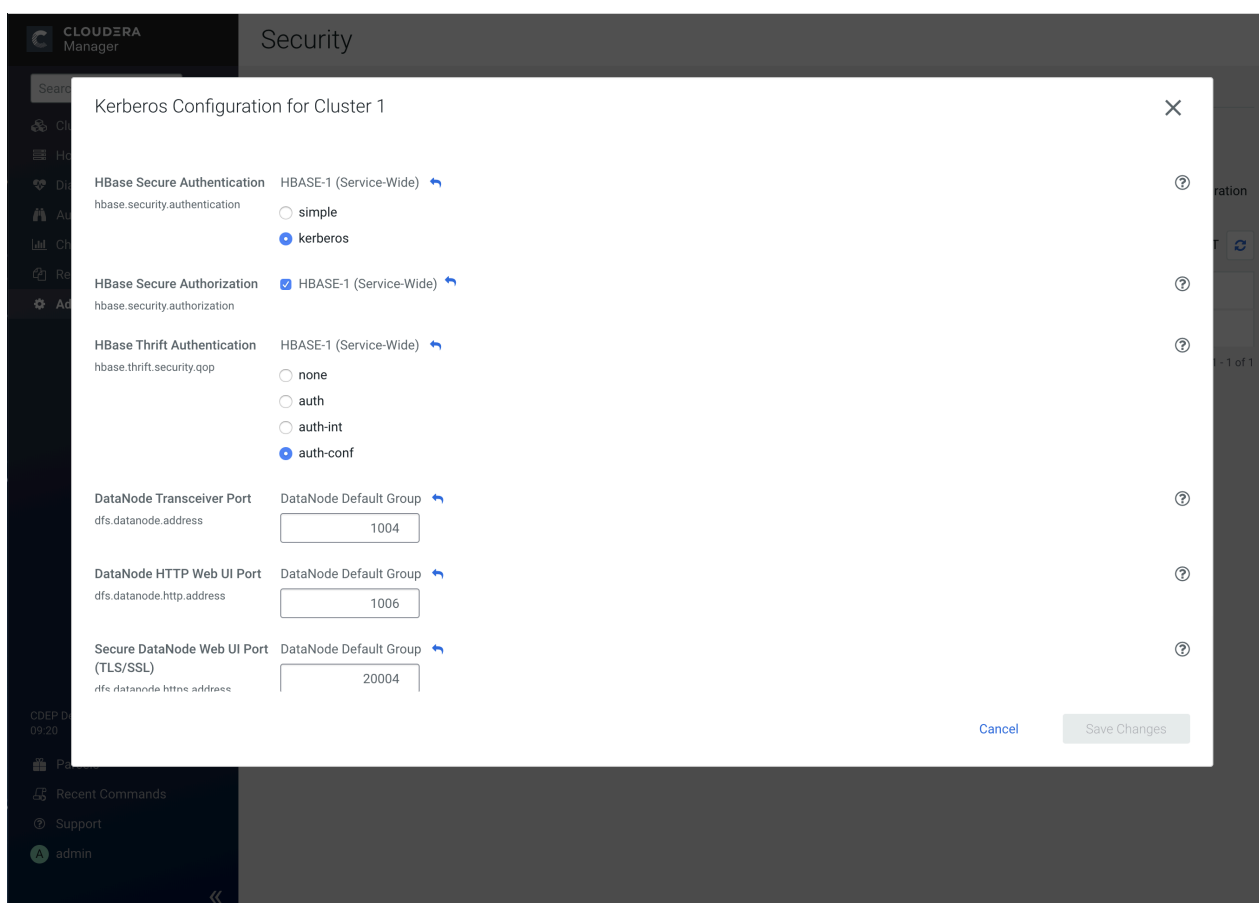


Results

To view details about Kerberos-enabled services, select Administration > Security, then click the applicable row in the Kerberos column.

The screenshot shows the Cloudera Manager interface. On the left is a dark sidebar with navigation links: Clusters, Hosts, Diagnostics, Audits, Charts, Replication, and Administration (highlighted). Below these are links for CDEP Deployment, Parcels, Recent Commands, Support, and a user profile for 'admin'. The main content area is titled 'Security' and has tabs for 'Status' and 'Kerberos Credentials'. Under 'Status', there are buttons for 'Enable Auto-TLS', 'TLS Settings', and 'Security Inspector'. A message states: 'This page allows user to enable Kerberos and HDFS Data Encryption that the wizard sets.' Below this is a search bar 'Search by cluster name'. A table shows 'Cluster 1' with a warning icon and the text '17 of 18 services are enabled'. A modal window is open, titled 'Services with Kerberos Enabled', listing 17 services: KUDU-1, ZOOKEEPER-1, HDFS-1, HBASE-1, OOZIE-1, HIVE-1, HUE-1, SOLR-1, KS_INDEXER-1, YARN-1, IMPALA-1, SPARK_ON_YARN-1, KAFKA-1, HIVE_ON_TEZ-1, LIVY-1, TEZ-1, and ZEPPELIN-1. Below this list, under 'Services with Kerberos Disabled', is 'SQOOP_CLIENT-1'. At the bottom of the modal is a button 'View Kerberos Configuration'. The background shows a 'Last Updated' timestamp and a 'Save Changes' button.

Click View Kerberos Configuration to view and edit configuration details for each service. Click Save Changes to save any configuration updates.

**Note:**

The first five steps of this wizard can also be performed before cluster creation by selecting Administration > Security > Kerberos Credentials > Setup KDC for this Cloudera Manager. If that has already been done, the first five steps of this wizard do not appear.

Step 5: Create the HDFS superuser

To create home directories for users, you need access to the HDFS superuser account.

About this task

CDP automatically creates the HDFS superuser account on each cluster host during CDP installation. When you enable Kerberos for the HDFS service, you lose access to the default HDFS superuser account using `sudo -u hdfs` commands. Cloudera recommends that you use a different user account as the superuser, rather than the default `hdfs` account.

Designating a Non-default Superuser Group

About this task

To designate a different group of superusers instead of using the default `hdfs` account:

Procedure

1. Open the Cloudera Manager Admin console and navigate to the HDFS service.
2. Click the Configuration tab.
3. Select Scope HDFS (Service-Wide) .

4. Select Category Security .
5. Locate the Superuser Group property and change the value to the appropriate group name for your environment. For example, `<superuser>`.
6. Enter a Reason for change, then click Save Changes to commit the changes.
7. Restart the HDFS service.

What to do next

To enable your access to the superuser account now that Kerberos is enabled, you must now create a Kerberos principal or an Active Directory user whose first component is `<superuser>`:

If you are using Active Directory

Add a new user account to Active Directory, `<superuser>@YOUR-REALM.COM`. The password for this account should be set to never expire.

If you are using MIT KDC

1. In the `kadmin.local` or `kadmin` shell, type the following command to create a Kerberos principal called `<superuser>`:

```
kadmin: addprinc <superuser>@YOUR-LOCAL-REALM.COM
```

This command prompts you to create a password for the `<superuser>` principal. You should use a strong password because having access to this principal provides superuser access to all of the files in HDFS.

2. To run commands as the HDFS superuser, you must obtain Kerberos credentials for the `<superuser>` principal. To do so, run the following command and provide the appropriate password when prompted.

```
kinit <superuser>@YOUR-LOCAL-REALM.COM
```

If you are using Red Hat IdM/FreeIPA

1. On the Identity Users page, click the Add button.
2. Specify the superuser principal name in the User login field, complete the remaining fields, then click Add.

Step 6: Get or create a Kerberos principal for each user account

How to create a Kerberos principal for a user account.

About this task

Now that Kerberos is configured and enabled on your cluster, you and every other Hadoop user must have a Kerberos principal or keytab to obtain Kerberos credentials to be allowed to access the cluster and use the Hadoop services. In the next step of this procedure, you will need to create your own Kerberos principals to verify that Kerberos security is working on your cluster. If you and the other Hadoop users already have a Kerberos principal or keytab, or if your Kerberos administrator can provide them, you can skip ahead to the next step.

If you are using Active Directory

Procedure

- Add a new AD user account for each new user that should have access to the cluster. You do not need to make any changes to existing user accounts.

If you are using MIT KDC

Procedure

1. In the kadmin.local or kadmin shell, use the following command to create user principals by replacing YOUR-LOCAL-REALM.COM with the name of your realm, and replacing USERNAME with a username:

```
kadmin: addprinc USERNAME@YOUR-LOCAL-REALM.COM
```

2. Enter and re-enter a password when prompted.

Step 7: Prepare the cluster for each user

Before users access the cluster, there are a few tasks you must complete to prepare the hosts for each user.

Procedure

1. Make sure all hosts in the cluster have a Linux user account with the same name as the first component of that user's principal name. For example, the Linux account joe should exist on every box if the user's principal name is joe@YOUR-REALM.COM. You can use LDAP for this step if it is available in your organization.



Note: Each account must have a user ID that is greater than or equal to 1000. In the `/etc/hadoop/conf/tas/kcontroller.cfg` file, the default setting for the `banned.users` property is `mapred, hdfs, and bin` to prevent jobs from being submitted using those user accounts. The default setting for the `min.user.id` property is 1000 to prevent jobs from being submitted with a user ID less than 1000, which are conventionally Unix super users.

2. Create a subdirectory under `/user` on HDFS for each user account (for example, `/user/joe`). Change the owner and group of that directory to be the user.

```
hadoop fs -mkdir /user/joe
hadoop fs -chown joe /user/joe
```



Note: `sudo -u hdfs` is not included in the commands above. This is because it is not required if Kerberos is enabled on your cluster. You will, however, need to have Kerberos credentials for the HDFS super user to successfully run these commands. For information on gaining access to the HDFS super user account, see “Step 5: Create the HDFS superuser”.

Related Information

[Step 5: Create the HDFS superuser](#)

Step 8: Verify that Kerberos security is working

Verify that Kerberos security is working by running test MapReduce jobs.

Before you begin

After you have Kerberos credentials, you can verify that Kerberos security is working on your cluster by trying to run MapReduce jobs. To confirm, try launching a sleep or a pi job from the provided Hadoop examples (`/usr/lib/hadoop/hadoop-examples.jar`).



Note:

This section assumes you have a fully-functional CDP cluster and you have been able to access HDFS and run MapReduce jobs before you followed these instructions to configure and enable Kerberos on your cluster. If you have not already done so, you should at a minimum use the Cloudera Manager Admin Console to generate a client configuration file to enable you to access the cluster.

Procedure

1. Acquire Kerberos credentials for your user account.

```
kinit USERNAME@YOUR-LOCAL-REALM.COM
```

2. Enter a password when prompted.
3. Submit a sample pi calculation as a test MapReduce job. Use the following command if you use a package-based setup for Cloudera Manager:

```
$ hadoop jar /usr/lib/hadoop-0.20-mapreduce/hadoop-examples.jar pi 10 10000
Number of Maps = 10
Samples per Map = 10000
...
Job Finished in 38.572 seconds
Estimated value of Pi is 3.14120000000000000000
```

If you have a parcel-based setup, use the following command instead:

```
$ hadoop jar /opt/cloudera/parcels/CDH/lib/hadoop-0.20-mapreduce/hadoop-examples.jar pi 10 10000
Number of Maps = 10
Samples per Map = 10000
...
Job Finished in 30.958 seconds
Estimated value of Pi is 3.14120000000000000000
```

What to do next

You have now verified that Kerberos security is working on your cluster.



Important:

Running a MapReduce job will fail if you do not have a valid Kerberos ticket in your credentials cache. You can examine the Kerberos tickets currently in your credentials cache by running the klist command. You can obtain a ticket by running the kinit command and either specifying a keytab file containing credentials, or entering the password for your principal. If you do not have a valid ticket, you will receive an error such as:

```
11/01/04 12:08:12 WARN ipc.Client:
Exception encountered while connecting to the server :
javax.security.sasl.SaslException:GSS initiate failed
[Caused by GSSException: No valid credentials provided (Mechanism level
: Failed to find any
Kerberos tgt)]
Bad connection to FS. command aborted. exception: Call to nn-host/10
.0.0.2:8020 failed on local exception:
java.io.IOException:javax.security.sasl.SaslException: GSS initiate f
ailed
[Caused by GSSException: No valid credentials provided
(Mechanism level: Failed to find any Kerberos tgt)]
```

Step 9: (Optional) Enable authentication for HTTP web consoles for Hadoop roles

Authentication for access to the web consoles for the HDFS and YARN roles can be enabled using a configuration option for the appropriate service.

Before you begin

Minimum Required Role: [Configurator](#) (also provided by Cluster Administrator, Limited Cluster Administrator, and Full Administrator)

Procedure

1. On the Clusters tab, select the service (HDFS or YARN) for which you want to enable authentication.
2. Click the Configuration tab.
3. Select Scope *service name* Service-Wide .
4. Type Enable Kerberos in the Search box.
5. Select Enable Kerberos Authentication for HTTP Web-Consoles.
6. Select Enable Kerberos Authentication for HTTP Web-Consoles.
7. Enter a Reason for change, then click Save Changes to commit the changes.
8. When the command finishes, restart all roles of that service.

Enabling SPNEGO as an Authentication Backend for Hue**Procedure**

1. In Cloudera Manager, set the authentication backend to SpnegoDjangoBackend.
 - a) Go to the Cloudera Manager Admin Console. From the Clusters tab, select the Hue service.
 - b) Click the Configuration tab.
 - c) Select Scope Service-Wide .
 - d) Select Category Security .
 - e) Locate the Authentication Backend property and select desktop.auth.backend.SpnegoDjangoBackend.
 - f) Click Save Changes.
2. Restart the Hue service.
3. If you are using an external load balancer, perform the following steps, otherwise skip the remaining steps. Cloudera Manager creates these configuration automatically:
 - a) On the host running the Hue Kerberos Ticket Renewer, switch to the KT_RENEWER process directory. For example:

```
cd /var/run/cloudera-scm-agent/process/`ls -lrt /var/run/cloudera-scm-agent/process/ | awk '{print $9}' | grep KT_RENEWER | tail -1`/
```

- b) Verify that the Hue keytab includes the HTTP principal.

```
klist -kte ./hue.keytab
Keytab name: FILE:./hue.keytab
KVNO Timestamp Principal
-----
1 03/09/15 20:20:35 hue/host-10-16-8-168.openstacklocal@EXAMPLE.CLOUDERA.COM (aes128-cts-hmac-sha1-96)
1 03/09/15 20:20:36 HTTP/host-10-16-8-168.openstacklocal@EXAMPLE.CLOUDERA.COM (aes128-cts-hmac-sha1-96)
```

- c) Copy the hue.keytab file to /var/lib/hue and change ownership to the hue user and group.

```
cp ./hue.keytab /var/lib/hue/
chown hue:hue /var/lib/hue/hue.keytab
```

- d) Go to the Cloudera Manager Admin Console. From the Clusters tab, select the Hue service.
- e) Click the Configuration tab.
- f) Select Scope Service-Wide .
- g) Select Category Advanced .

- h) Locate the Hue Service Environment Advanced Configuration Snippet (Safety Valve) property and add the following line:

```
KRB5_KTNAME=/var/lib/hue/hue.keytab
```

- i) Enter a Reason for change, then click Save Changes to commit the changes.
j) Restart the Hue service.

Kerberos authentication for non-default users

The steps described here are only applicable if you are running one or more CDP services with non-default users.

Procedure

- If you have modified the default value for the System User property for any service in Cloudera Manager, you must only perform the command (as described below) corresponding to that service, in order to successfully run jobs with the non-default user.

HBase	<p>Give the hbase user ownership of the HBase root directory:</p> <pre>sudo -u hdfs hadoop fs -chown -R hbase \${hbase.rootdir}</pre> <p>By default, hbase.rootdir is /hbase.</p>
Hive	<p>Give the hive user ownership of the /user/hive directory.</p> <pre>sudo -u hdfs hadoop fs -chown hive /user/hive</pre>
YARN	<p>For every NodeManager host, for each path in yarn.nodemanager.local-dirs, run:</p> <pre>rm -rf \${yarn.nodemanager.local-dirs}/usercache/*</pre> <p>This removes the /usercache directory that contains intermediate data stored for previous jobs.</p>

Customizing Kerberos principals

How to configure custom service principals in Cloudera Manager.

Before you begin

- Ensure you use different Kerberos principals for different services to make it easier to track the HDFS directories being accessed by each service.
- If you are using ShellBasedUnixGroupsMapping to obtain user-group mappings, ensure you have the UNIX accounts for the principals present on all hosts of the cluster.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

- Ranger

Ranger creates all plugin services and related policies with default service user names. If you customize the principal names using Cloudera Manager for any service, you must manually update all the policies and plugin service configs to use the customized principal names.

By default, Ranger audit directory ownership is `/ranger/audit/atlas` - owner: `atlasfoo0`. If the Ranger Audit directory is not accessible by custom service principal, then you must change ranger audit directory ownership. To do so, add Ranger hdfs policy for atlas service principal on resource `<auditdir>/atlas`. For example, `/ranger/audit/atlas`.

Use one of the 3 following options to ensure that Ranger AuthZ works correctly:

Option 1: You can manually add/update the plugin service configurations and default policies so that Ranger plugin services provide authorization correctly, as policies define.

For example, to customize the HadoopSQL policy:

- In the Ranger Admin Web UI Service Manager HadoopSQL, click Edit.
- Add the custom principal name used by each of the following services:
 - `tag.download.auth.users`
 - `policy.download.auth.users`
 - `policy.grantrevoke.auth.users`
- Update each default policy, by replacing the default prefix "all-*" with a custom principal name.

Each service then uses the customized principal name instead of the default service user name.

Option 2: If you have not added new policies or modified existing default policies, you can rename existing plugin service user mapping properties.



Note: This example shows each service principal customised.

- In Ranger Web UI, add custom plugin service user mapping properties in the Ranger Admin `safety-valve` for `ranger-admin-site.xml` to have custom principal values. For example, if default HDFS service principal is `hdfs`, the custom principal value should be `hdfsfoo0` and so on.

Table 2: Ranger Plugin Service Names and Principals

Ranger Plugin Service	Property key	Property value
HDFS	<code>ranger.plugins.hdfs.serviceuser</code>	<code>hdfsfoo0</code>
HBASE	<code>ranger.plugins.hbase.serviceuser</code>	<code>hbasefoo0</code>
HIVE	<code>ranger.plugins.hive.serviceuser</code>	<code>hivefoo0</code>
YARN	<code>ranger.plugins.yarn.serviceuser</code>	<code>yarnfoo0</code>
KAFKA	<code>ranger.plugins.kafka.serviceuser</code>	<code>kafkafoo0</code>
KNOX	<code>ranger.plugins.knox.serviceuser</code>	<code>knoxfoo</code>
IMPALA	<code>ranger.plugins.impala.serviceuser</code>	<code>impalafoo0</code>
CRUISE CONTROL	<code>ranger.plugins.cruise_control.serviceuser</code>	<code>cruisecontrolfoo0</code>
STREAMS REPLICATION MANAGER	<code>ranger.plugins.streams_replication_manager.serviceuser</code>	<code>streamsreprgrfoo0</code>
STREAMS MESSAGING MANAGER	<code>ranger.plugins.streams_messaging_manager.serviceuser</code>	<code>streamsmgrfoo0</code>
SOLR	<code>ranger.plugins.solr.serviceuser</code>	<code>solrfoo0</code>

Ranger Plugin Service	Property key	Property value
SCHEMAREGISTRY	ranger.plugins.schemaregistry.serviceuser	schemaregistryfoo0
OZONE	ranger.plugins.ozone.serviceuser	ozonefoo0
NIFI	ranger.plugins.nifi.serviceuser	nififoo0
NIFI REGISTRY	ranger.plugins.nifiregistry.serviceuser	nifiregistryfoo0
RANGER TAGSYNC (Role in Ranger service)	ranger.plugins.tagsync.serviceuser	rangertagsyncfoo0

2. In Cloudera Manager Ranger Actions run Setup Plugin Services.

This will create all Ranger plugin services with policies that give permissions to customized principals.



Note: These properties are only required if the user is not managing auth-to-local rules to map service principals to service user names.



Note: If using Ranger KMS / Ranger KMS KTS service in a custom principal environment, you must add the following properties in Ranger Admin safety-valve for ranger-admin-site.xml:

1. ranger.kms.service.user.hive = <custom-hive-principal>
2. ranger.kms.service.user.hdfs = <custom-hdfs-principal>
3. ranger.kms.service.user.hbase = <custom-hbase-principal>



Note: Also, if using Ranger KMS / Ranger KMS KTS service in a custom principal environment, you must update the Hadoop KMS Blacklist Decrypt EEK property to have custom hdfs principal value in Ranger KMS / Ranger KTS service.

If your Knox service uses a custom service principal (for example., knoxfoo0), you must update the Ranger Knox proxy properties in ranger-admin-site.xml safety valve,

```
<property>
  <name>ranger.proxyuser.knoxfoo0.users</name>
  <value>*</value>
</property>
<property>
  <name>ranger.proxyuser.knoxfoo0.groups</name>
  <value>*</value>
</property>
<property>
  <name>ranger.proxyuser.knoxfoo0.hosts</name>
  <value>*</value>
</property>
```

The existing Ranger Knox Proxy properties shown on the Cloudera Manager UI in Ranger are meant for default service principal - knox. You must update them with the following values:



Note: Ideally, these should be non-existent on the cluster.

```
ranger_proxyuser_knox_hosts = _no_host_
ranger_proxyuser_knox_groups = _no_group_
```

```
ranger_proxyuser_knox_users = _no_user_
```

If the Ranger KMS or Ranger KMS with KTS service is used in an environment in which custom kerberos principals are configured,

1. In Advanced Configuration Snippet (Safety Valve) for conf/kms-site.xml add the following configuration properties:

- hadoop.kms.proxyuser.<custom-principal-name>.groups
- hadoop.kms.proxyuser.<custom-principal-name>.hosts

with a * value to the Advanced Configuration Snippet (Safety Valve) for conf/kms-site.xml for the custom kerberos principal names of the following services:

- Hue
- HDFS
- HttpFS
- Zeppelin
- Livy
- YARN
- MapRed
- Hive
- Oozie

2. Set the existing Proxy User Groups and Proxy User Hosts configuration properties with a _no_group_ and _no_host_ value respectively for the default kerberos principal names of the services in the preceding list, using the following steps:

- a. In Cloudera Manager, go to Clusters Ranger KMS Configuration .
- b. Enter kms-site.xml in Search to find Advanced Configuration Snippet (Safety Valve) for conf/kms-site.xml.
- c. In Advanced Configuration Snippet (Safety Valve) for conf/kms-site.xml add the following configuration properties:

- hadoop.kms.proxyuser.<custom-principal-name>.groups
- hadoop.kms.proxyuser.<custom-principal-name>.hosts

with a * value for the custom kerberos principal names of the services to the following services:

- Hue
- HDFS
- HttpFS
- Zeppelin
- Livy
- YARN
- MapRed
- Hive
- Oozie

- d. Enter Proxy User in Search to find Proxy User Groups and Proxy User Hosts.
- e. Set a _no_group_ or _no_host_ value respectively for each of the existing Proxy User Groups and Proxy User Hosts properties for the default kerberos principal names of the services mentioned above.
- f. Click Save Changes.
- g. Restart the Ranger KMS or Ranger KMS with KTS service.

If your Ranger RMS service uses a custom principal name (for example - rangermsfoo0), you must configure HMS to use rangermsfoo0 as a super user. To do so,

Add the following property using the HMS configuration page in Cloudera Manager Hive Service Advanced Configuration Snippet (Safety Valve) for core-site.xml :

```
hadoop.proxyuser.ranger.rmsfoo0.hosts=*
```

Update the existing Hive Metastore Access Control and Ranger RMS Proxy User Hosts property (which is meant for default principal name - ranger.rms) from * to no_host_.

After updating all the properties above, use Cloudera Manager to Restart Stale Services.

Option 3: Use auth-to-local rule mapping to map custom principals to default service user names.

You can add auth-to-local rules, using Cloudera Manager HDFS Configuration Additional Rules to Map Kerberos Principals to Short Names.



Note: You must configure Ranger Admin to add Audit Filters:

If you set up custom service principals for a cluster, you must

- Update the ranger.accesslogs.exclude.users.list property to use the custom principal names and then restart Ranger Admin.
- Manually update the required users in the audit-filters in each plugin service config.

in order to ensure accurate audit logging.

- Configuring Ranger Admin role with custom principals for a template-based install.

If you use a template to set up a cluster with customized principals, you must configure the Ranger Admin role, by adding properties and values in roleConfigGroups.

1. Update existing Ranger Knox proxy configs for the default Knox principal.

```
{
  "name": "ranger_proxyuser_knox_users",
  "value": "_no_user_"
},
{
  "name": "ranger_proxyuser_knox_groups",
  "value": "_no_group_"
},
{
  "name": "ranger_proxyuser_knox_hosts",
  "value": "_no_host_"
}
```

2. Update conf/ranger-admin-site.xml_role_safety_valve to have the Ranger Knox proxy configs override for Knox custom principal name, for example: Knoxfoo0.

```
{
  "name": "conf/ranger-admin-site.xml_role_safety_valve",
  "value": "<property>
    <name>ranger.proxyuser.knoxfoo0.users</name>
    <value>*</value>
  </property>
  <property>
    <name>ranger.proxyuser.knoxfoo0.groups</name>
    <value>*</value>
  </property>
  <property>
    <name>ranger.proxyuser.knoxfoo0.hosts</name>
    <value>*</value>
  </property>"
}
```

3. Add `ranger.plugins.<service>.serviceuser` configs override in `conf/ranger-admin-site.xml_role_safety_valve` to have the custom principal name used by each Ranger plugin supported services.

For example, if Hdfs service is using `hdfsfoo0` principal then the config will be `ranger.plugins.hdfs.serviceuser=hdfsfoo0`. This will help to create default policies for custom principal name into Ranger Admin.

```
{
  "name": "conf/ranger-admin-site.xml_role_safety_valve",
  "value": "<property>
    <name>ranger.plugins.hdfs.serviceuser</name>
    <value>hdfsfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.hive.serviceuser</name>
    <value>hivefoo0</value>
  </property>
  <property>
    <name>ranger.plugins.hbase.serviceuser</name>
    <value>hbasefoo0</value>
  </property>
  <property>
    <name>ranger.plugins.yarn.serviceuser</name>
    <value>yarnfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.knox.serviceuser</name>
    <value>knoxfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.kafka.serviceuser</name>
    <value>kafkafoo0</value>
  </property>
  <property>
    <name>ranger.plugins.atlas.serviceuser</name>
    <value>atlas</value>
  </property>
  <property>
    <name>ranger.plugins.impala.serviceuser</name>
    <value>impalafoo0</value>
  </property>
  <property>
    <name>ranger.plugins.cruise_control.serviceuser</name>
    <value>cruisecontrolfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.schemaregistry.serviceuser</name>
    <value>schemaregistryfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.streams_messaging_manager.serviceuser</
name>
    <value>streamsmmsgmgrfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.streams_replication_manager.serviceuser</name>
    <value>streamsrepmgrfoo0</value>
  </property>
  <property>
    <name>ranger.plugins.solr.serviceuser</name>
    <value>solrfoo0</value>
  </property>"
}
```

- }
4. If installing RANGER_KMS service, you must add the configurations that specify custom principal names of Hdfs, Hbase, Hive services into `conf/ranger-admin-site.xml_role_safety_valve`. This helps to create default policies for these service principal names for Ranger KMS service (`cm_kms`) into Ranger Admin.

```
{
  "name": "conf/ranger-admin-site.xml_role_safety_valve",
  "value": "<property>
    <name>ranger.kms.service.user.hdfs</name>
    <value>hdfsfoo0</value>
  </property>
  <property>
    <name>ranger.kms.service.user.hive</name>
    <value>hivefoo0</value>
  </property>
  <property>
    <name>ranger.kms.service.user.hbase</name>
    <value>hbasefoo0</value>
  </property>"
}
```

Related Information

[Hadoop Users \(user:group\) and Kerberos Principals](#)

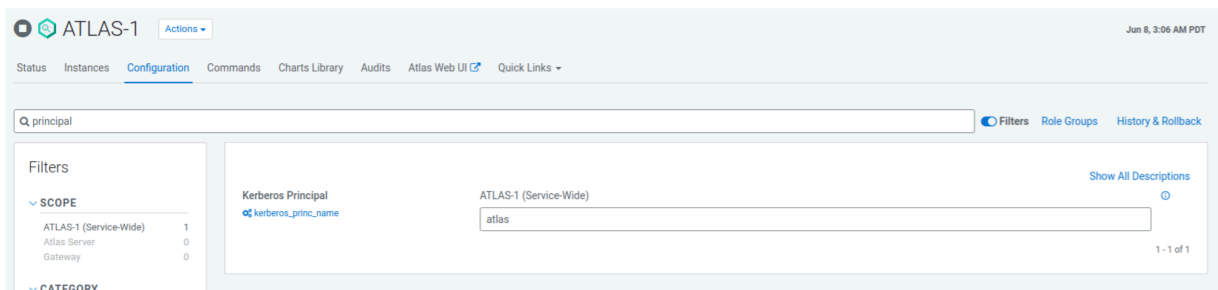
Configuring custom Kerberos principal for Atlas

Customising the Atlas Kerberos Principal is a two-step process.

Procedure

1. Updating the Kerberos Principal.

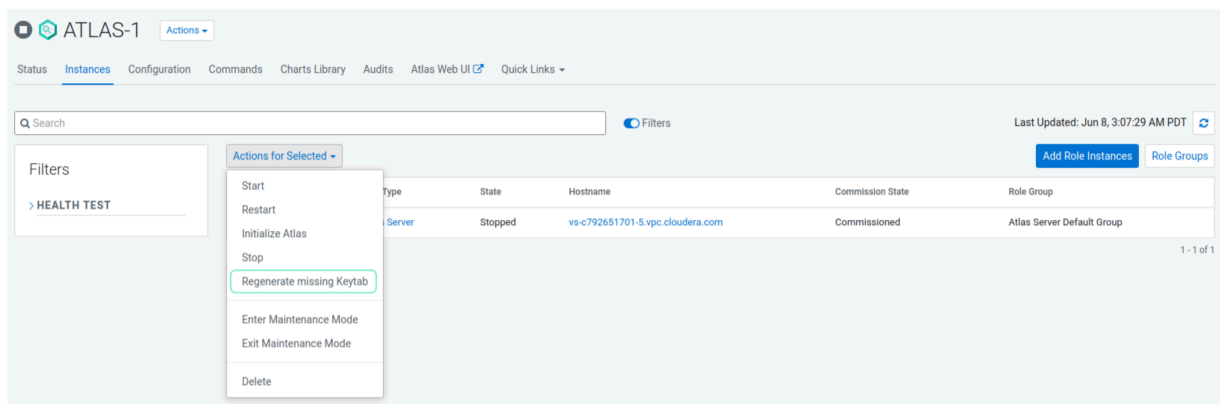
In your Cloudera Manager instance, go to the Configuration tab and search for the Principal by entering "principal" in the search field.



For Kerberos Principal, enter the value as “atlas” and click Save Changes.

2. Regenerating the missing keytab.

In the Instances tab, click Actions to Selected and select Regenerate missing keytab. Click Save.



Note: Updating the Atlas Kerberos Principal results in stale configurations for services. You must restart the stale services.

Warning: Cloudera Manager will not create service users / groups which are customised.

Cloudera Manager handles the mapping of the service user to the Kerberos Principal and no additional task is required. You must configure the required policies in the Ranger UI.



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

If the Kerberos principal name is customized for a Knox service having a default service user name, add the following proxy configurations to Atlas Server Advanced Configuration Snippet (Safety Valve) for conf/atlas-application.properties and restart the Atlas service:

- atlas.proxyuser.<knox_principal_name>.hosts= <list of allowed hosts>. The <list of allowed hosts> can be provided as * to allow all.
- atlas.proxyuser.<knox_principal_name>.groups= <list of allowed groups>
- atlas.proxyuser.<knox_principal_name>.users= <list of allowed users>

Where <knox_principal_name> is the value of the Kerberos Principal in the Knox service. Select Clusters > Knox > Configuration and search for Kerberos Principal to display this value.



Attention: Custom principals are used as service users to create the required policies. You must ensure that the UNIX account associated with Custom Principals is available on all hosts and must be mapped with the appropriate groups. Else, you have appropriate auth-to-local rules present to map the Custom Principals to the service users and appropriate required policy is present in Ranger.

Specially for Atlas, if you have custom service principal, you must add the same to Kafka policies if you have not mapped auth-to-local rules in Kafka configurations. Else, you must have the Atlas service user in the Kafka policies. Note that Kafka supports auth-to-local rules with a custom property named sasl.kerberos.principal.to.local.rules

For more information, see [Enable Kerberos Authentication](#).

Configuring custom Kerberos principal for Cruise Control

The Kerberos principal for Cruise Control is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select Cruise Control from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering "kerberos" in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.
7. Click on Actions > Restart next to the Cruise Control service name to restart the service.

What to do next

If you use Ranger for authorization, update all resource-based services and policies that use the old principal and add the new principal. For more information on updating resource-based services and policies, see *Using Ranger to Provide Authorization in CDP*.

Configuring custom Kerberos principal for Apache Flink

The Kerberos principal for Flink is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select Flink from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering kerberos in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.
7. Click Actions > Restart next to the Flink service name to restart the service.

Configuring custom Kerberos principal for HBase

The Kerberos principal for HBase is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom Kerberos principal in Cloudera Manager.

About this task

After changing the Kerberos Principal to the required value in Cloudera Manager, you have to change the owner of the HBase folders in HDFS to the new custom Kerberos principal name. Then, the ACLs for the ZNodes that are managed by HBase have to be changed in ZooKeeper.



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Perform the steps given below to configure a custom Kerberos principal for HBase.

Procedure

1. Stop the HBase service and set the custom Kerberos principal in Cloudera Manager:

- a) Log in to Cloudera Manager as an Administrator.
- b) In Cloudera Manager, click Clusters > HBase.
- c) Click Actions > Stop to stop the Hbase service.
- d) Go to the Configuration tab.
- e) Search for the Kerberos Principal by entering "kerberos" in the search field.
- f) For Kerberos Principal, enter the required custom principal value.
- g) Click Save Changes.



Important: Do not restart the HBase service until the remaining steps given below are performed.

2. Change the owner of the HBase HDFS directories:

To change the owner of the HBase folders in HDFS to the new custom Kerberos principal name, use the `chown` command as an HDFS superuser.

```
hdfs dfs -chown -R newhbaseprincipal:newhbaseprincipal /hbase
```

If Ranger is used, use the `chown` command as an HDFS superuser to change the owner of the Ranger HBase log directory in HDFS.

```
hdfs dfs -chown -R newhbaseprincipal:newhbaseprincipal /ranger/audit/hbase
```

3. Change the HBase principals configured in Ranger.

If Ranger is used, log in to the Ranger web UI and perform the following steps:

- a) In the Service Manager page, click the Edit icon of the HBase service to open the Edit Service page, and replace the original principal with the custom principal in all the fields in which the original principal is used.
- b) In the Service Manager page, under HBASE, click the `cm_hbase` link to navigate to the configuration page for `cm_hbase` policies, and replace the original HBase principal in each policy with the custom principal.

4. Change the ACLs in ZooKeeper for the /hbase node.

To change the ACLs in ZooKeeper, use either one of the following two options:

Option 1 - Changing the ACLs:

- a) Log in to the ZooKeeper CLI as the old HBase Kerberos principal that is currently owning the HBase ZNodes. See *Configure ZooKeeper client shell for Kerberos authentication* for information on configuring authentication for `zkClient.sh`.
- b) The ZNodes that are managed by HBase are under the /hbase ZNode. For each ZNode (including the root ZNode, for example, "/hbase"), list the ACLs by using the `getAcl` command and then change the ACLs by using the `setAcl` command to use the new principal.

Configuration example of ZNodes that can be accessed only by HBase:

```
getAcl /hbase/tokenauth/keys
'sasl','hbase
: cdrwa

setAcl /hbase/tokenauth/keys sasl:newhbaseprincipal:cdrwa
```

Configuration example of ZNodes that can be read by any user but can be changed only by HBase:

```
getAcl /hbase
```

```
'sas1','hbase
: cdrwa
'world','anyone
: r

setAcl /hbase sas1:newhbaseprincipal:cdrwa,world:anyone:r
```



Note: Ensure that you start changing the ACLs from the leaf nodes, and then work towards the root, because you cannot access the nodes with the original principal after the setAcl command is used.

Option 2 - Deleting and recreating all HBase ZNodes:



Important: Use this option only for freshly installed HBase clusters. Using this option for HBase clusters that are not freshly installed could lead to loss of some HBase configuration files that are stored in ZooKeeper, such as replication-related configuration files.

- a) Stop the HBase service.
- b) Log in to the ZooKeeper CLI as a super user or as the old HBase Kerberos principal that is currently owning the HBase ZNodes.
- c) Delete all HBase ZNodes, including the root ZNode for HBase (/hbase, by default) by using the `deleteall /hbase` command.

5. Restart the HBase service, and any stale services.

After performing the steps given above, click Actions > Start to restart the HBase service from Cloudera Manager, restart any stale services, and redeploy any stale configurations.

Configuring custom Kerberos principal for HDFS

The Kerberos principal for HDFS is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Log in to Cloudera Manager as an Administrator.
2. Go to Clusters > HDFS service > Configuration and search for the Kerberos Principal by entering "kerberos" in the search field.
3. Enter the custom Kerberos principal in the Kerberos Principal field.
This Kerberos principal short name is used by all the roles of HDFS.
4. Click Save Changes and restart the HDFS service.

Configuring custom Kerberos principal for Hive and Hive-on-Tez

Use the steps given here to configure a custom Kerberos principal for Hive and Hive-on-Tez.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Create a new Hive custom Kerberos principal, for example, hivefoo, by using the `kadmin` command.

```
kadmin
  addprinc -pw example hivefoo
  xst -k /tmp/hivefoo.keytab
```

2. Create a linux user on all hosts of this cluster.

```
useradd hivefoo
usermod -a -G hive hivefoo
```

3. In Cloudera Manager, go to Clusters > HIVE and click Actions > Stop to stop the Hive services.
4. In Cloudera Manager, go to Clusters > HIVE > Configuration and search for “Kerberos”.
5. Enter the custom Kerberos principal, hivefoo, in the Kerberos Principal field.
6. The `/hiveserver2` node is created when the HiveServer2 is launched for the first time. All instance nodes are created under `/hiveserver2`. When the kerberos principal name is changed, the parent node must be deleted so that a new parent node can be automatically recreated with the new ACL.

```
kinit zookeeper

zookeeper-client
  delete /hiveserver2
```

7. Use the following commands to set up the HDFS user home directory:

```
kinit hdfs
hadoop fs -mkdir /user/hivefoo
hadoop fs -chown hivefoo:hive /user/hivefoo
```

8. In Cloudera Manager, go to Clusters > YARN > Configuration and search for Allowed System Users. Use the Add (+) icon to add hivefoo to the list of Allowed System Users.
9. In Cloudera Manager, go to Clusters > HIVE and click Actions > Start to start Hive services.

Configuring custom Kerberos principal for HttpFS

To use custom Kerberos principal for HttpFS:

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Log in to Cloudera Manager as an Administrator.
2. Go to Clusters > HDFS service > Configuration and search for *Kerberos Principal*.
3. Enter the custom Kerberos principal in the Role-Specific Kerberos Principal field (for the HttpFs Default Group).
4. Click Save Changes and restart the HttpFS service.

Configuring custom Kerberos principal for Hue

The Kerberos principal for Hue is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.



Important: Currently the names of system users which are impersonating users with Solr should match with the names of their respective Kerberos principals. If changing both the user name and the principal is not possible, you must add the user name you want to associate with the custom Kerberos principal to Solr configuration via the Solr Service Environment Advanced Configuration Snippet (Safety Valve) environment variable in Cloudera Manager.

Procedure

1. Log in to Cloudera Manager as an Administrator.
2. Go to Clusters Hue service Configuration and search for "Kerberos".
3. Enter the custom Kerberos principal in the Kerberos Principal field.

This Kerberos principal short name is used by all roles associated with this service.

If you have secured your cluster using Knox, and if Knox uses custom Kerberos principal, then you must set the following configuration in the Hue Service Advanced Configuration Snippet (Safety Valve) for hue_safety_valve.ini field:

```
[desktop]
[[knox]]
knox_principal=[**KERBEROS-PRINCIPAL-SHORT-NAME**]
# example: knox_principal=knoxfoo0
```

4. Click Save Changes and restart the Hue service.

Configuring Kerberos Authentication

Impala supports an enterprise-grade authentication system called Kerberos. Kerberos provides strong security benefits including capabilities that render intercepted authentication packets unusable by an attacker. It virtually eliminates the threat of impersonation by never sending a user's credentials in cleartext over the network.

Requirements for Using Impala with Kerberos



Important:

- If you plan to use Impala in your cluster, you must configure your KDC to allow tickets to be renewed, and you must configure krb5.conf to request renewable tickets. Typically, you can do this by adding the max_renewable_life setting to your realm in kdc.conf, and by adding the renew_lifetime parameter to the libdefaults section of krb5.conf.

Impala supports the Cloudera ODBC driver and the Kerberos interface provided. To use Kerberos through the ODBC driver, the host type must be set depending on the level of the ODBC driver:

- SecImpala for the ODBC 1.0 driver.
- SecBeeswax for the ODBC 1.2 driver.
- Blank for the ODBC 2.0 driver or higher, when connecting to a secure cluster.
- HS2NoSasl for the ODBC 2.0 driver or higher, when connecting to a non-secure cluster.

Enabling Kerberos in Impala-shell

To enable Kerberos in the Impala shell, start the `impala-shell` command using the `-k` flag.

Configuring Impala to Support Kerberos Security

Enabling Kerberos authentication for Impala involves steps that can be summarized as follows:

- Creating service principals for Impala and the HTTP service. Principal names take the form: *serviceName/fully.qualified.domain.name@KERBEROS.REALM*
- Creating, merging, and distributing key tab files for these principals.
- Editing `/etc/default/impala` (in cluster not managed by Cloudera Manager), or editing the Security settings in the Cloudera Manager interface, to accommodate Kerberos authentication.

Enabling Access to Internal Impala APIs for Kerberos Users

For applications that need direct access to Impala APIs, without going through the HiveServer2 or Beeswax interfaces, you can specify a list of Kerberos users who are allowed to call those APIs. By default, the `impala` and `hdfs` users are the only ones authorized for this kind of access. Any users not explicitly authorized through the `_principals_whitelist` configuration setting are blocked from accessing the APIs. This setting applies to all the Impala-related daemons, although currently it is primarily used for HDFS to control the behavior of the catalog server.

Customizing Kerberos Principals for Impala



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

1. In Cloudera Manager, click Clusters > Impala to go to the Impala service.
2. Click the Configuration tab.
3. Select Scope > Impala (Service-Wide).
4. In the Kerberos Principal field, add the custom Kerberos principal name to be used by all roles of this service.
5. Click Save Changes.
6. In the Instances tab, click Actions to Selected and select Regenerate missing keytab. Click Save.
7. After setting the new kerberos principal name, restart stale services.
8. In order to be able to regenerate missing keytabs, stop role instances.

Mapping Kerberos Principals to Short Names for Impala

Impala can support the additional mapping rules that will be inserted before rules generated from the list of trusted realms and before the default rule. The support is disabled by default in Impala.

To enable mapping Kerberos principals to short names:

1. In Cloudera Manager, select the Impala service.
2. In the Configuration tab, select Impala (Service-Wide) in Scope and Advanced in Category.
3. Select the Use HDFS Rules to Map Kerberos Principals to Short Names field.
4. Click Save Changes, and restart the Impala service.

Configuring the Kerberos principal used by Kafka

In a Kerberos-enabled cluster, the Kafka service uses the `kafka` principal by default. Changing the default principal and using custom principals is supported. Principals can be configured on a service-wide level in Cloudera Manager with the Kerberos Principal property.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

If you are using a custom process user, ensure that the custom Kerberos principal is set to the default Kafka service principal.

Before you begin

Access to Kafka znodes is restricted by default. Configuring the principal is only possible if access to the Kafka znodes in Zookeeper is unlocked. As a result, you must ensure that access to znodes is unlocked. For more information, see “Configuring the Kerberos principal used by Kafka”.

Procedure

1. In Cloudera Manager select the Kafka service.
2. Go to Configuration.
3. Find the Kerberos Principal property and enter your principal.
4. Click Save Changes.
5. Restart the Kafka service.

Results

The custom principal is configured for Kafka. Kafka uses the configured principal.

What to do next

- Restrict znode access. For more information, see *Restricting access to Kafka metadata in Zookeeper*.
- If you use Ranger for authorization, update the principal in all resource-based services and policies that use the old principal.

The exact services and policies you need to update depend on your environment and cluster setup. At minimum you need to update the principal in the Kafka and Solr resource-based services. For more information on updating resource-based services and policies, see *Using Ranger to Provide Authorization in CDP*

- Update all Kafka clients to use the new principal.

Related Information

[Restricting access to Kafka metadata in Zookeeper](#)

[Using Ranger to Provide Authorization in CDP](#)

Configuring custom Kerberos principal for Knox

Use the steps given here to configure a custom Kerberos principal for Knox.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

To configure custom Kerberos principal for Knox:

Procedure

1. In Cloudera Manager, go to Knox > Configuration .
2. Search for the Kerberos Principal by entering "kerberos" in the search field
3. Find the Kerberos Principal property and enter the custom Kerberos principal name.
4. Click Save Changes.
5. Click Actions > Restart .

Configuring custom Kerberos principal for Kudu

You can configure a custom Kerberos principal for Kudu using Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. In Cloudera Manager, navigate to **Kudu Configuration**.
2. Search for **kerberos**.
3. Find the Kerberos principal property and set it to the required name.
4. Click **Save changes**.
Custom Kerberos principal for Kudu is applied for not just the Kudu server but also for the Hive and Impala clients.
5. For components that are not controlled by Cloudera Manager, configure the SASL protocol name.
You must add the SASL protocol name configuration wherever the Kudu client properties, such as master addresses, are configured.

For example, if the principal name is `kudu/_HOST` set the protocol to `kudu`.

Configuring custom Kerberos principal for Livy

The Kerberos principal for Apache Livy is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select Livy from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering "kerberos" in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click **Save Changes**.
7. Click **Actions > Restart** next to the Livy service name to restart the service.

Configuring custom Kerberos principal for NiFi and NiFi Registry

The Kerberos principal for NiFi and NiFi Registry is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select NiFi or NiFi Registry from the list of services.

3. Select Configuration tab.
4. Search for the *Kerberos principal* by entering *kerberos* in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.
7. Click on Actions > Restart next to the NiFi or NiFi Registry service name to restart the service

Configuring custom Kerberos principal for Omid

Use the steps given here to configure a custom Kerberos principal for Omid.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Start the HBase shell as the HBase superuser. See *Use the HBase shell* for information on starting the HBase shell.
2. Grant rwx (read, write, execute) permissions to the new custom principal linked to the Omid tables:

```
grant 'NEW_OMID_PRINCIPAL', 'RWX', 'OMID_COMMIT_TABLE' ;  
grant 'NEW_OMID_PRINCIPAL', 'RWX', 'OMID_TIMESTAMP_TABLE' ;
```

3. Log in to Cloudera Manager as an Administrator.
4. In Cloudera Manager, click Clusters > Omid.
5. Go to the Configuration tab.
6. Search for the Kerberos Principal by entering "kerberos" in the search field.
7. For Kerberos Principal, enter the required custom principal value.
8. Click Save Changes.
9. Click Actions and select Restart to restart the service.

Configuring custom Kerberos principal for Oozie

The Kerberos principal for Ozone is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. In Cloudera Manager, click Clusters > Oozie .
2. Go to the Configuration tab
3. Search for the Kerberos Principal by entering "kerberos" in the search field.
4. For Kerberos Principal, enter your custom principal value.
5. Click Save Changes.
6. Click Actions and select Restart to restart the service.

Configuring custom Kerberos principal for Ozone

The Kerberos principal for Ozone is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. In Cloudera Manager, go to Ozone > Configuration .
2. Search for *Kerberos principal*.
3. Enter the custom Kerberos principals for the various Ozone roles.
4. Click Save Changes and restart the Ozone service.

Configuring custom Kerberos principal for Phoenix

Use the steps given here to configure a custom Kerberos principal for Phoenix.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

To configure a custom Kerberos principal for Phoenix:

Procedure

1. Log in to Cloudera Manager as an Administrator.
2. In Cloudera Manager, go to Clusters > Phoenix.
3. Go to the Configuration tab.
4. Search for the Kerberos Principal by entering "kerberos" in the search field.
5. For Kerberos Principal, enter the required custom principal value.
6. Click Save Changes.
7. In Cloudera Manager, go to Clusters > HDFS.
8. Go to the Configuration tab.
9. Locate the Cluster-wide Advanced Configuration Snippet (Safety Valve) for core-site.xml property or search for it by typing its name in the Search box.
10. Click View as XML, and add the following properties:

```
<property>
  <name>hadoop.proxyuser.NEW_PHOENIX_PRINCIPAL.hosts</name>
  <value>*</value>
</property>
<property>
  <name>hadoop.proxyuser.NEW_PHOENIX_PRINCIPAL.groups</name>
  <value>*</value>
</property>
```

where the NEW_PHOENIX_PRINCIPAL is the custom principal name.

11. Enter a Reason for change, and then click Save Changes to commit the changes.

12. Restart all stale services.

Customizing the Kerberos principal for Schema Registry

The Kerberos principal for Schema Registry is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your cluster in Cloudera Manager.
2. Select Schema Registry from the list of services.
3. Select the **Configuration** tab.
4. Search for the Kerberos Principal by entering kerberos in the search field.
5. Enter a custom name in the Kerberos Principal field.
6. Click Save changes.
7. Click on **Action Restart** next to the Schema Registry service name to restart the service.

Configuring custom Kerberos principals and custom system users for Solr

In a Kerberos enabled cluster, the Solr service uses the solr principal by default. Changing the default principal and using custom principals is supported. Principals can be configured on a service-wide level in Cloudera Manager with the Kerberos Principal property. To configure a custom system user, you need to modify the System User property.

Before you begin

Make sure you have the following privileges:

- SSH access to the cluster where you want to enable the custom principal
- administrative privileges in Cloudera Manager
- HDFS super user access

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.



Note:

Procedure

1. Stop the Solr service.

2. Disable ZooKeeper ACL checking temporarily.
 - a) In Cloudera Manager, navigate to ZooKeeper Configuration .
 - b) Find the Java Configuration Options for ZooKeeper Server property.
 - c) Add the following value:


```
-Dzookeeper.skipACL=yes
```
 - d) Click Save Changes.
 - e) Restart the ZooKeeper service.
3. In Cloudera Manager, navigate to Clusters Solr service Configuration and find the Kerberos Principal property.
4. Provide the custom Kerberos principal.
5. Click Save Changes.
6. To be able to interact with the Solr service, you must either change the System User name to match the custom Kerberos principal, or add the existing System User name to Solr Service Environment Advanced Configuration Snippet (Safety Valve).

Select one of the following options:

Option

Change the System User name to match the custom Kerberos principal

- a. In Cloudera Manager, navigate to Clusters Solr service Configuration and find the System User property.
- b. Change the user name to match the custom Kerberos principal you have set.
- c. Click Save Changes.

Keep the original System User name

- a. In Cloudera Manager navigate to Clusters Solr service Configuration and find the Solr Service Environment Advanced Configuration Snippet (Safety Valve) property.
- b. Look for the SOLR_SECURITY_PROXY_JAVA_OPTS key.
- c. Append its value with:


```
-Dsolr.security.proxyuser.r.[***SYSTEM_USER***].groups=* -Dsolr.security.proxyuser.[***SYSTEM_USER***].hosts=*

Replace [***SYSTEM_USER***] with the service user name you want to associate with the custom Kerberos principal.
```
- d. Click Save Changes.

7. Create a jaas.conf file containing the following:

```
Client {
    com.sun.security.auth.module.Krb5LoginModule required
    useKeyTab=false
    useTicketCache=true
    principal
    =" [ ***CUSTOM_SOLR_KERBEROS_PRINCIPAL@KERBEROS_REALM_NAME*** ] ";
};
```

Replace [***CUSTOM_SOLR_KERBEROS_PRINCIPAL@KERBEROS_REALM_NAME***] with your Kerberos principal and realm name.

8. Set the `LOG4J_PROPS` environment variable to a `log4j.properties` file:

```
export LOG4J_PROPS=/etc/zookeeper/conf/log4j.properties
```

9. Set the `ZKCLI_JVM_FLAGS` environment variable:

```
export ZKCLI_JVM_FLAGS="-Djava.security.auth.login.config=/path/to/jaas.conf \
-DzkACLProvider=org.apache.solr.common.cloud.SaslZkACLProvider \
-Droot.logger=INFO,console \
-Dsolr.authorization.superuser=[***CUSTOM_SOLR_KERBEROS_PRINCIPAL***]"
```

10. Authenticate as the `[***CUSTOM_SOLR_KERBEROS_PRINCIPAL***]`:

```
kinit [***CUSTOM_SOLR_KERBEROS_PRINCIPAL@KERBEROS_REALM_NAME***]
```

Replace `[***CUSTOM_SOLR_KERBEROS_PRINCIPAL@KERBEROS_REALM_NAME***]` with your Kerberos principal and realm name.

11. Run the `zkcli.sh` script as follows:

```
/opt/cloudera/parcels/CDH/lib/solr/bin/zkcli.sh -zkh
ost [***ZOOKEEPER_SERVER_HOSTNAME***]:[***ZOOKEEPER_SERVER_PORT***] -cmd
updateacls /solr
```

Replace `[***ZOOKEEPER_SERVER_HOSTNAME***]` and `[***ZOOKEEPER_SERVER_PORT***]` with the hostname and port of a ZooKeeper server.

For example:

```
/opt/cloudera/parcels/CDH/lib/solr/bin/zkcli.sh -zkhost zk01.example.com
:2181 -cmd updateacls /solr
```

12. Check ACLs in Zookeeper:

```
zookeeper-client -server ${HOSTNAME}:2181 getAcl /solr
```

13. Change ownership of Solr's HDFS Data Directory. Check the value in Cloudera Manager under Solr Configuration HDFS Data Directory .

14. Execute the following command as the HDFS superuser:

```
hdfs dfs -chown -R [***CUSTOM_SOLR_KERBEROS_PRINCIPAL***] [***HDFS_DATA_DIRECTORY***]
```

15. Re-enable ZooKeeper ACL check.

- In Cloudera Manager, navigate to ZooKeeper Configuration .
- Find the Java Configuration Options for ZooKeeper Server property.
- Remove the following value:

```
-Dzookeeper.skipACL=yes
```

- Click Save Changes.
- Restart the ZooKeeper service.

Configuring custom Kerberos principal for Spark

The Kerberos principal for Apache Spark is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: By default, Cloudera Manager configures CDP services to use the default Kerberos principal names. While it is possible to customize the Kerberos principal names for most cluster services by setting various configuration properties, it requires extensive custom configuration and, if absolutely required, we highly recommend working closely with Cloudera Professional services in doing so.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select Spark from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering "kerberos" in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.
7. Click Actions > Restart next to the Spark service name to restart the service.

Configuring custom Kerberos principal for Streams Messaging Manager

In a Kerberos-enabled cluster, Streams Messaging Manager uses the *streamsmgmgr* Kerberos principal to connect to Kafka and Schema Registry. The principal can be customized in Cloudera Manager with the Kerberos Principal property.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. In Cloudera Manager, go to Streams Messaging Manager > Configuration .
2. Find the Kerberos Principal property and enter your principal.
3. Click Save Changes.
4. Restart the service.

What to do next

If you use Ranger for authorization, update all resource-based services and policies that use the old principal and add the new principal. For more information on updating resource-based services and policies, see *Using Ranger to Provide Authorization in CDP*.

Configuring custom Kerberos principal for SQL Stream Builder

The Kerberos principal for SQL Stream Builder is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Go to your Cluster in Cloudera Manager.

2. Select SQL Stream Builder from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering kerberos in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.
7. Click Actions > Restart next to the SQL Stream Builder service name to restart the service

Configuring the Kerberos principal used by SRM

In a Kerberos-enabled cluster, the Streams Replication Manager (SRM) service uses the streamsrepmgr principal by default. The principal can be configured in Cloudera Manager with the Kerberos Principal property.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

The principal specified in the Kerberos Principal property is used by the SRM service (Driver and Service roles) when it establishes a connection with its co-located Kafka cluster. Additionally, this principal is also used for Kerberos-enabled clusters defined with a Kafka credential, but only if there is no specific JAAS configuration set for that cluster.

For example, if you have a Kerberos-enabled external Kafka cluster that you defined with a Kafka credential, but did not specify a JAAS configuration, SRM falls back to using the default JAAS configuration which contains the principal defined in the Kerberos Principal property.



Important: The principal set in the Kerberos Principal property is only used by the SRM service. Configuring the property does not affect the principal used by the srm-control tool. For more information on how to configure the srm-control tool, see *Configuring srm-control*.

Procedure

1. In Cloudera Manager select the SRM service.
2. Go to Configuration.
3. Find the Kerberos Principal property and enter the custom Kerberos principal.
4. Click Save Changes.
5. Restart the SRM service.

Results

The custom principal used by SRM is configured.

What to do next

If you use Ranger for authorization, update all resource-based services and policies that use the old principal and add the new principal. For more information on updating resource-based services and policies, see *Using Ranger to Provide Authorization in CDP*.

Related Information

[Using Ranger to Provide Authorization in CDP](#)

[Configuring srm-control](#)

Enabling custom Kerberos principal support in YARN

By default Cloudera Manager sets the Kerberos principal in YARN to yarn. This value can be easily changed using Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Procedure

1. Disable the ZooKeeper ACL check temporarily.

- a) In Cloudera Manager, navigate to **ZooKeeper Configuration**.
- b) Find the **Java Configuration Options for ZooKeeper Server** property.
- c) Add the following value:

```
-Dzookeeper.skipACL=yes
```

- d) Click **Save Changes**.
- e) Restart the ZooKeeper service.

2. In Cloudera Manager, navigate to **YARN Configuration**.

3. Find the **Kerberos principal** property and set it to the required name.

4. Click **Save Changes**.

5. Find the **Admin ACL** property and ensure that it contains either the `${yarn_user}` placeholder or the updated principal name value.

6. Ensure that YARN HDFS folders have the correct access rights and owners.

For example, if you use the Capacity Scheduler Node labels feature, the `yarn.node-labels.fs-store.root-dir` folder could be inaccessible by YARN with the new Kerberos principal name. To resolve this issue, make it accessible or use the `hdfs chown` command. The following is the minimum list of folder paths for which ownership needs to be changed if Capacity Scheduler Node labels are enabled:

- `/yarn/node-labels`
- `/user/yarn/mapreduce/mr-framework`
- `/user/yarn/services/service-framework/*`
- `/tmp/logs`

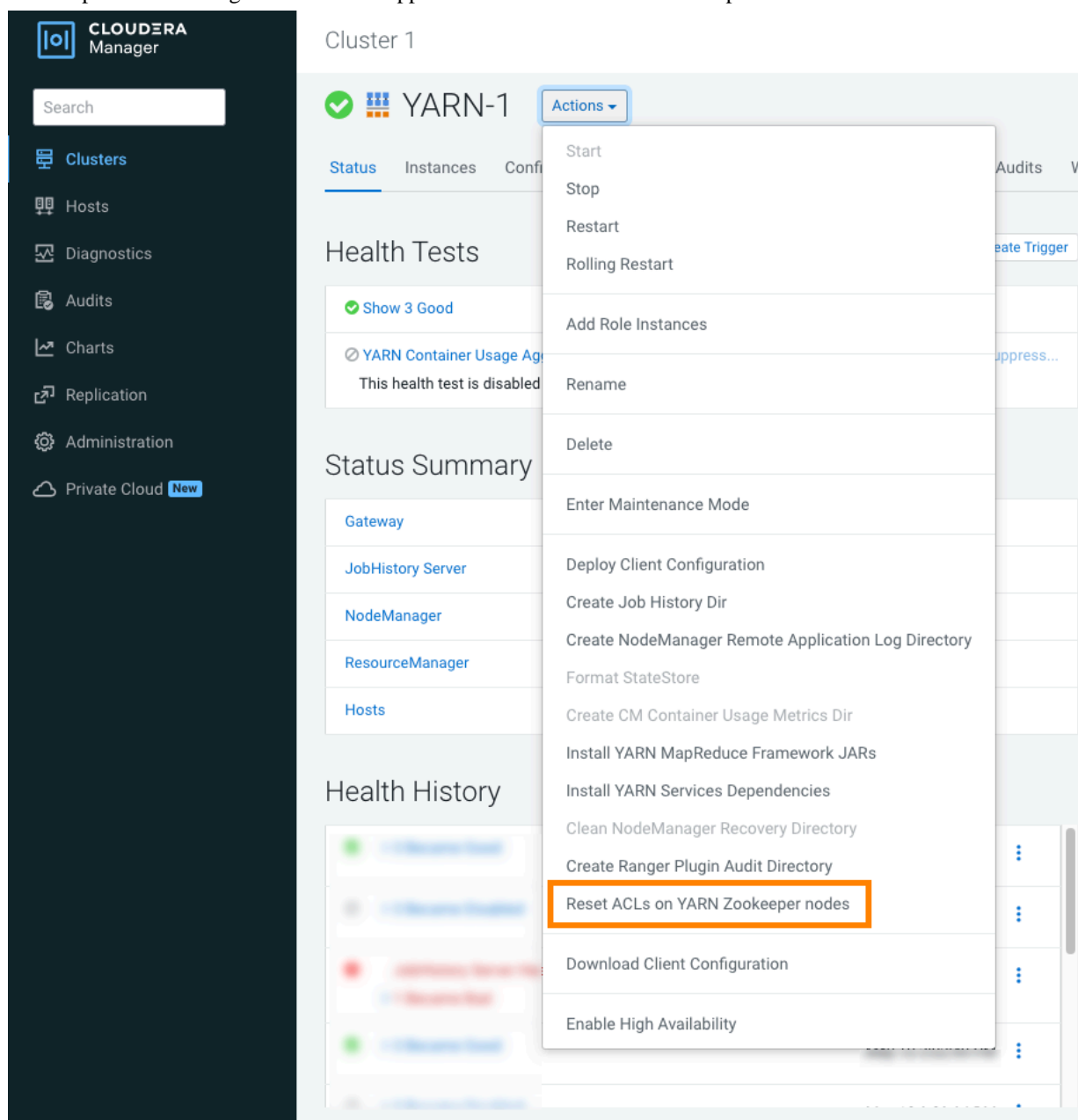
7. Restart all services with stale configuration.

- a) Click **Stale configuration: Restart needed**.
- b) Ensure that **Deploy client configuration** is selected.
- c) Click **Restart**.

8. Select the YARN service.

9. Click Actions Reset ACLs on ZooKeeper nodes .

This step can take a long time if a lot of application data is stored in ZooKeeper.



10. Enable the ZooKeeper ACL check.

- a) Navigate to ZooKeeper Configuration .
- b) Find Java Configuration Options for ZooKeeper Server.
- c) Remove the -Dzookeeper.skipACL=yes value.
- d) Click Save Changes.
- e) Restart the ZooKeeper service.

Enabling custom Kerberos principal support in a Queue Manager cluster

In a secure Queue Manager cluster you can enable custom Kerberos principal using Cloudera Manager.

About this task



Important: Cloudera Manager configures CDP services to use the default Kerberos principal names. Cloudera recommends that you do not change the default Kerberos principal names. If it is unavoidable to do so, contact Cloudera Professional Services because it requires extensive additional custom configuration.

Before you begin

Ensure your Queue Manager cluster is secure. For that check if it runs on port 7183.

Procedure

1. In Cloudera Manager, navigate to **YARN Configuration**.
2. Search for admin acl.
3. Find the Admin ACL (yarn_admin_acls) property.
4. Add the user you want to use for the Kerberos principal to the list of Admin ACL property.
5. Click Save Changes.
6. Restart the YARN service to avoid staleness.
7. Navigate to **Queue Manager Configuration**.
8. Search for kerberos principal.
9. Find the Kerberos Principal (kerberos_princ_name) property.
10. Add the same user you added to the Admin ACL property.
11. Click Save Changes.
12. Restart the YARN Queue Manager service to avoid staleness.

If you get the Exception: Only admins can carry out this operation error message while doing Queue Manager operations, ensure that the principal name is added to the YARN Admin ACL



Failed to add queue. [More](#)

Validation failed for Add q
standalone="yes"?><Remo
<message>java.lang.Excep
<javaClassName>org.apac
</RemoteException>

list.

Configuring custom Kerberos principal for Zeppelin

The Kerberos principal for Apache Zeppelin is configured by default to use the same service principal as the default process user. However, you can change the default setting by providing a custom principal in Cloudera Manager.

About this task



Important: By default, Cloudera Manager configures CDP services to use the default Kerberos principal names. While it is possible to customize the Kerberos principal names for most cluster services by setting various configuration properties, it requires extensive custom configuration and, if absolutely required, we highly recommend working closely with Cloudera Professional services in doing so.

Procedure

1. Go to your Cluster in Cloudera Manager.
2. Select Zeppelin from the list of services.
3. Go to the Configuration tab.
4. Search for the Kerberos principal by entering "kerberos" in the search field.
5. Provide a custom name to the Kerberos Principal property.
6. Click Save Changes.

7. Click Actions > Restart next to the Zeppelin service name to restart the service.

Configuring custom Kerberos principal for ZooKeeper

Use the steps given here to configure a custom Kerberos principal for ZooKeeper.

About this task



Important: By default, Cloudera Manager configures CDP services to use the default Kerberos principal names. While it is possible to customize the Kerberos principal names for most cluster services by setting various configuration properties, it requires extensive custom configuration and, if absolutely required, we highly recommend working closely with Cloudera Professional services in doing so.

Procedure

1. Log in to Cloudera Manager as an Administrator.
2. In Cloudera Manager, click Clusters > ZooKeeper.
3. Go to the Configuration tab.
4. Search for the Kerberos Principal by entering "kerberos" in the search field.
5. For Kerberos Principal, enter the required custom principal value.
6. Click Save Changes.
7. Click Actions and select Restart to restart the service.

Managing Kerberos credentials using Cloudera Manager

How to regenerate Kerberos principals in Cloudera Manager.

Related Information

[Configuring a dedicated MIT KDC for cross-realm trust](#)

[Step 3: Create the Kerberos Principal for Cloudera Manager Server](#)

About this task

Minimum Required Role: [Full Administrator](#). This feature is not available when using Cloudera Manager to manage Data Hub clusters.

When Kerberos authentication is enabled for HDFS service instances, Cloudera Manager starts creating Kerberos principals for each role instance on the cluster at the end of the configuration process. Depending on the number of hosts and the number of HDFS role instances in the cluster, the process may take anywhere from a few seconds to several minutes.

After the process completes, view the list of Kerberos principals created for the cluster by using the Cloudera Manager Admin Console. Every host with HDFS role instances should have Kerberos principals.

If no principals have been created after 10 minutes, there may be an issue with the process.



Important:

- Do not regenerate the principals for your cluster unless you have made a global configuration change, such as changing the encryption type.
- Regenerate principals using the Cloudera Manager Admin Console only. Do not use kadmin shell.
- For an MIT KDC, see “Configuring a dedicated MIT KDC for cross-realm trust” to avoid invalidating existing host keytabs.

Updating Kerberos credentials in Cloudera Manager

About this task

If you change the user name or the password (or both) in the Active Directory KDC for the account used by Cloudera Manager for Kerberos authentication, you must also change it in Cloudera Manager. These credentials were stored during the Kerberos integration process (see “Step 3: Create the Kerberos Principal for Cloudera Manager Server”).

Procedure

1. Log in to Cloudera Manager Admin Console.
2. Select Administration Security .
3. Click the Kerberos Credentials tab.
4. Click Setup KDC for this Cloudera Manager.
5. Enter the new user and password for the principal added to the Kerberos KDC in “Step 4: Enter Account Credentials”.

If you are using Red Hat IdM/FreeIPA, enter the IPA admin credentials here. These admin credentials are not stored, and are used only to create a new user and role (named `cmadin-<random_id>` and `cmadminrole`, respectively) and retrieve its keytab. Cloudera Manager stores this keytab for future Kerberos operations, such as regenerating the credentials of the CDP service accounts.

Managing Active Directory account properties

About this task

If you are using an Active Directory KDC, Cloudera Manager lets you configure Active Directory accounts and customize the credential regeneration process using the Cloudera Manager Admin Console. You can also use Cloudera Manager to configure the encryption types to be used by your Active Directory account. Once you modify any Active Directory account properties, you must regenerate Kerberos credentials to reflect those changes. The credential regeneration process requires you to delete existing accounts before new ones are created.

By default, Cloudera Manager does not delete accounts in Active Directory, which means that to regenerate Kerberos principals contained in Active Directory, you need to manually delete the existing Active Directory accounts. You can either delete and regenerate all existing Active Directory accounts, or only delete those with the `userPrincipalName` (or login name) that you will later manually select for regeneration. If the accounts haven't already been deleted manually, the regeneration process will throw an error message saying that deletion of accounts is required before you proceed.

Modifying Active Directory account properties using Cloudera Manager

About this task

If you are using an Active Directory KDC, you can configure Active Directory account properties such as `objectClass` and `accountExpires` directly from the Cloudera Manager Admin Console. Any changes to these properties will be reflected in the regenerated Kerberos credentials.

Procedure

1. Go to the Cloudera Manager Admin Console and click the Administration tab.
2. Select Administration Settings .
3. Click the Kerberos category.
4. Locate the Active Directory Account Properties and edit as required. By default, the property will be set to:

```
accountExpires=0,objectClass=top,objectClass=person,objectClass=organizationalPerson,objectClass=user
```

5. Locate the Active Directory Password Properties and edit the field as needed. By default, the property will be set to:

```
length=12,minLowerCaseLetters=2,minUpperCaseLetters=2,minDigits=2,minSpaces=0,minSpecialChars=0,specialChars=?.!$%^*()-_+=~
```

6. Click Save Changes.
7. Regenerate new credentials with the new properties.

Enabling credential regeneration for Active Directory accounts using Cloudera Manager

About this task

To avoid having to delete accounts manually, enable the Active Directory Delete Accounts on Credential Regeneration property. By default, this property is disabled. After enabling this feature, Cloudera Manager will delete existing Active Directory accounts automatically when new ones are created during regeneration.

Procedure

1. On the Cloudera Manager Admin Console, click the Administration tab.
2. Select Administration Settings .
3. Click the Kerberos category.
4. Locate the Active Directory Delete Accounts on Credential Regeneration and check the property to activate this capability.
5. Click Save Changes.

Configuring encryption types for Active Directory KDC using Cloudera Manager

About this task

Cloudera Manager allows you to configure the encryption types (or enctype) used by an Active Directory KDC to protect its data. Cloudera supports the following encryption types:

- rc4-hmac
- aes128-cts
- aes256-cts
- des-cbc-crc
- des-cbc-md5

To configure encryption types for an Active Directory KDC:

Procedure

1. Go to the Cloudera Manager Admin Console and click the Administration tab.
2. Select Administration Settings .
3. Click the Kerberos category.
4. Locate the Kerberos Encryption Types and click **+** to add the encryption types you want Active Directory to use (see the list above for supported encryption types encetypes).
5. Check the checkbox for the Active Directory Set Encryption Types property. This will automatically set the Cloudera Manager AD account to use the encryption types configured in the previous step.
6. Click Save Changes.

Moving Kerberos principals to another OU within Active Directory

About this task

If you have a Kerberized cluster configured with an Active Directory KDC, you can use the following steps to move the Kerberos principals from one AD Organizational Unit (OU) to another.

Procedure

1. Create the new OU on the Active Directory Server.
2. Use AD's Delegate Control wizard to set the permissions on the new OU such that the configured Cloudera Manager admin account has the ability to Create, Delete and Manage User Accounts within this OU.
3. Stop the cluster.
4. Stop the Cloudera Management Service.
5. In Active Directory, move all the Cloudera Manager and CDP components' user accounts to the new OU.
6. In Cloudera Manager, select Administration Security .
7. On the Kerberos Credentials tab, click Configuration.
8. Select Scope Settings .
9. Select Category Kerberos .
10. Locate the Active Directory Suffix property and edit the value to reflect the new OU name.
11. Click Save Changes.

Viewing or regenerating Kerberos credentials using Cloudera Manager

About this task

To view Kerberos principals for the cluster from Cloudera Manager for either MIT Kerberos or Active Directory:

Procedure

1. Log in to Cloudera Manager Admin Console.
2. Select Administration Security .
3. Click the Kerberos Credentials tab. The currently configured Kerberos principals for services running on the cluster display, such as:
 - For HDFS, principals hdfs/hostname and host/hostname
4. To regenerate any principals (if necessary):
 - Select the principal from the list.
 - Click Regenerate.

Running the Security Inspector

About this task

The Security Inspector uses the Host Inspector to run a security-related set of commands on the hosts in your cluster. It reports on matters such as how Java is configured for encryption and on the default realms configured on each host:

Procedure

1. Select Administration Security .
2. Click Security Inspector. Cloudera Manager begins several tasks to inspect the managed hosts.
3. After the inspection completes, click Download Result Data or Show Inspector Results to review the results.

Using a custom Kerberos keytab retrieval script

How to manually create principals and keytabs using a custom retrieval script.

About this task

The Cloudera Manager Kerberos setup procedure requires you to create an administrator account for the Cloudera Manager user. Cloudera Manager will then connect to your KDC and use this admin account to generate principals and keytabs for the remaining CDP services. If for some reason, you cannot create a Cloudera Manager administrator account on your KDC with the privileges to create other principals and keytabs for CDP services, then these will need to be created manually.

Cloudera Manager gives you the option to use a custom script to retrieve keytabs from the local filesystem. To use a custom Kerberos keytab retrieval script:

Procedure

1. The KDC administrators should create the required principals and keytabs, and store them securely on the Cloudera Manager Server host.
2. Create the keytab retrieval script. Your script should take two arguments: a full principal name for which it should retrieve a keytab, and a destination to which it can write the keytab. The script must be executable by the Cloudera Manager admin user, cloudera-scm. Depending on the principal name input by Cloudera Manager, the script should locate the corresponding keytab on the Cloudera Manager Server host (stored in step 1), and copy it into a location accessible to the cloudera-scm user. Here is a simple example:

```
#!/bin/bash
# Cloudera Manager will input a destination path
DEST="$1"
# Cloudera Manager will input the principal name in the format: <service>/
# <fqdn>@REALM
PRINC="$2"

# Assuming the '<service>_<fqdn>@REALM.keytab' naming convention for key
# tab files
IN=$(echo $PRINC | sed -e 's/\//_/' )
SRC="/keytabs/${IN}.keytab"

# Copy the keytab to the destination input by Cloudera Manager
cp -v $SRC $DEST
```

Note that the script will change according to the keytab naming convention followed by your organization.

There are special requirements when providing your own keytabs and using this sample script:

- Do not use the Keytab File Owner:Group values listed in “Hadoop Users (user:group) and Kerberos Principals”; instead ensure that the Cloudera Manager user (cloudera-scm) has read access to the keytabs that you are creating.
- Create keytabs for the individual principals (e.g., "hive/host.example.com@EXAMPLE.COM")
- Name the keytab files for these individual principals matching the paradigm "<service>_<fqdn>@REALM.keytab". For example, Filename (*.keytab) = "hive_host.example.com@realm.keytab".

3. Configure the location for the script in Cloudera Manager:
 - a) Go to the Cloudera Manager Admin console.
 - b) Select Administration Settings .
 - c) Select Category Kerberos .
 - d) Locate the Custom Kerberos Keytab Retrieval Script and set it to point to the script created in step 2.
 - e) Click Save Changes.

4. Once the Custom Kerberos Keytab Retrieval Script property is set, whenever Cloudera Manager needs a keytab, it will ignore all other Kerberos configuration and run the keytab retrieval script to copy the required keytab to the desired destination.
5. Cloudera Manager can now distribute the keytab to the services that need access to it.

Related Information

[Hadoop Users \(user:group\) and Kerberos Principals](#)

Adding trusted realms to the cluster

How to specify trusted realms in Cloudera Manager.

Before you begin

The Kerberos instance associated with a given cluster has its *REALM-NAME* specified as the `default_realm` in the Kerberos configuration file (`krb5.conf`) on the cluster's NameNode. Rules defined in the `hadoop.security.auth_to_local` property translate the Kerberos principals to local account names at the host level. The default rules simply remove the `@REALM` portion of the Kerberos principal and leave the short name.

To allow principals from other realms to use the cluster, the trusted realms must be specified in Cloudera Manager. For example, the Kerberos realm used by your cluster may have a trust relationship to a central Active Directory or MIT Kerberos realm. Add the central realm to the cluster as detailed in the following steps so that Cloudera Manager can apply the appropriate mapping rules to the principals from the trusted realm to access the cluster's services.

To specify trusted realms using Cloudera Manager:

Procedure

1. Log in to the Cloudera Manager Admin Console.
2. Select ClustersHDFS Service.
3. Click the Configuration tab.
4. Select HDFS (Service-Wide) for the Scope filter.
5. Select Security for the Category filter.
6. In the Search field, type Kerberos Realms to find the Trusted Kerberos Realms and Additional Rules to Map Kerberos Principals to Short Names settings.
7. Add other Kerberos realms that the cluster's realm can trust. Use all upper-case letters to specify the REALM name for MIT Kerberos or Active Directory realms:

```
ANOTHER-REALM.EXAMPLE.COM
```

To add multiple realms, click the plus (+) button.

8. Click Save Changes.

What to do next

For each trusted realm identified in Trusted Kerberos Realms, default mapping rules automatically strip the REALM name. To customize the mapping rules, specify additional rules in the Additional Rules to Map Kerberos Principals to Short Names setting, one rule per line. Cloudera Manager will wrap each rule in the appropriate XML tags and add to the generated `core-site.xml` file. To create custom rules and translate mixed-case Kerberos principals to lower-case Hadoop usernames.

If you specify custom mapping rules for a Kerberos realm using the Additional Rules to Map Kerberos Principals to Short Names setting, ensure that the same realm is not specified in the Trusted Kerberos Realms setting. If it is, the auto-generated rule (which only strips the realm from the principal and does no additional transformations) takes precedent, and the custom rule is ignored.

For these changes to take effect, you must restart the cluster and redeploy the client configuration, as follows:

1. On the Cloudera Manager Admin Console, Clusters Cluster-*n* to choose cluster-wide actions.
2. From the Actions drop-down button, select Deploy Client Configuration.

Using auth-to-local rules to isolate cluster users

How to use auth-to-local rules to restrict user access to specific clusters.

About this task

By default, the Hadoop auth-to-local rules map a principal of the form <username>/<hostname>@<REALM> to <username>. This means if there are multiple clusters in the same realm, then principals associated with hosts of one cluster would map to the same user in all other clusters.

For example, if you have two clusters, cluster1-host-[1..4].example.com and cluster2-host-[1..4].example.com, that are part of the same Kerberos realm, EXAMPLE.COM, then the cluster2 principal, hdfs/cluster2-host1.example.com@EXAMPLE.COM, will map to the hdfs user even on cluster1 hosts.

To prevent this, use auth-to-local rules as follows to ensure only principals containing hostnames of cluster1 are mapped to legitimate users.

Procedure

1. Go to the HDFS Service Configuration tab.
2. Select Scope HDFS (Service-Wide) .
3. Select Category Security .
4. In the Search field, type Additional Rules to find the Additional Rules to Map Kerberos Principals to Short Names settings.
5. Additional mapping rules can be added to the Additional Rules to Map Kerberos Principals to Short Names property. These rules will be inserted before the rules generated from the list of trusted realms (configured above) and before the default rule.

```
RULE:[2:$1/$2@$0](hdfs/cluster1-host1.example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
RULE:[2:$1/$2@$0](hdfs/cluster1-host2.example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
RULE:[2:$1/$2@$0](hdfs/cluster1-host3.example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
RULE:[2:$1/$2@$0](hdfs/cluster1-host4.example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
RULE:[2:$1/$2@$0](hdfs.*@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/nobody/
```

In the example, the principal hdfs/<hostname>@REALM is mapped to the hdfs user if <hostname> is one of the cluster hosts. Otherwise it gets mapped to nobody, thus ensuring that principals from other clusters do not have access to cluster1.

If the cluster hosts can be represented with a regular expression, that expression can be used to make the configuration easier and more conducive to scaling. For example:

```
RULE:[2:$1/$2@$0](hdfs/cluster1-host[1-4].example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
```

```
RULE:[2:$1/$2@$0](hdfs.*@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/nobody/
```

**Note:**

It is not possible to use alternatives in capturing or non-capturing groups within the matching portion of the rule, because the use of round brackets in the expression is not currently supported. For example, the following rule would result in an error:

```
RULE:[2:$1/$2@$0](hdfs/cluster1-(hosta|hostb|hostc).example.com@EXAMPLE.COM)s/(.*)@EXAMPLE.COM/hdfs/
```

**Note:**

In CM 7.3.1, added `auth_to_local` rules that map the first component of the principal name to the lowercase system user name.

New behavior for CM 7.4.4 and later: `auth_to_local` rules that map the first component of the principal name to the lowercase system user name are added only when you select the Set Rules to Map Kerberos Principals to Lower Case Short Names check box and you enable Kerberos.

6. Click Save Changes.
7. Restart the HDFS service and any dependent services.

Configuring a dedicated MIT KDC for cross-realm trust

How to configure a cluster-dedicated KDC and default realm in Cloudera Manager.

Related Information

[Hadoop Users \(user:group\) and Kerberos Principals](#)

About this task

Using Cloudera Manager to configure Kerberos authentication for the cluster creates several principals and keytabs automatically. Cloudera Manager also deploys the keytab files to every host in the cluster. See “Hadoop Users (user:group) and Kerberos Principals” for complete listing.



Note: The example below is specific for creating and deploying principals and keytab files for MIT Kerberos. See the appropriate documentation for other Kerberos implementations, such as Microsoft Active Directory, as needed.

Local and Remote Kerberos Admin Tools

About this task

Kerberos administrator commands can be run directly on the KDC server host or remotely, as shown in the table:

<code>kadmin.local</code>	Requires root access or Kerberos admin account. Use to log on directly to the KDC host.
<code>kadmin</code>	Use the logon to the KDC host system from another remote host over the network.

- To run Kerberos administration commands locally on the KRB host system:

```
sudo kadmin.local
```

Enter your Linux system password (for the sudo).

- To run Kerberos administration commands from any host:

```
kadmin
```

Enter your Kerberos administrator password.



Note: Commands shown for the kadmin shell can also be run at the kadmin.local shell.

Setting up a Cluster-Dedicated KDC and Default Realm for the Hadoop Cluster

About this task

Cloudera has tested the following configuration approaches to Kerberos security for clusters managed by Cloudera Manager. For administration teams that are just getting started with Kerberos security, we recommend starting with these approaches to the configuration of KDC services for a number of reasons.

The number of Service Principal Names (SPNs) that are created and managed by the Cloudera Manager server for a CDP cluster can be significant, so it is important to realize the potential impact on cluster uptime and overall operations if you choose to manage keytabs manually instead. The Cloudera Manager server manages the creation of service keytabs on the proper hosts based on the current configuration of the database. Manual keytab management can be error prone and introduce delays when deploying or moving services within the cluster, especially under time-sensitive conditions.

Cloudera Manager creates SPNs within a KDC that it can access with the kadmin command based on configuration of the `/etc/krb5.conf` file on the Cloudera Manager host. SPNs are created with the format `service-name/host.fqdn.name@EXAMPLE.COM` where `service-name` is the relevant CDP service name such as `hue` or `hbase` or `hdfs`.

If your site already has a working KDC, and any existing principals share the same name as any of the principals that Cloudera Manager creates, the Cloudera Manager Server generates a new randomized key for those principals, and consequently causes existing keytabs to become invalid.

This is why Cloudera recommends using a dedicated local MIT Kerberos KDC and realm for the Hadoop cluster. You can set up a one-way cross-realm trust from the cluster-dedicated KDC and realm to your existing central MIT Kerberos KDC, or to an existing Active Directory realm. Using this method, there is no need to create Hadoop service principals in the central MIT Kerberos KDC or in Active Directory, but principals (users) in the central MIT KDC or in Active Directory can be authenticated to Hadoop. The steps to implement this approach are as follows:

Procedure

1. Install and configure a cluster-dedicated MIT Kerberos KDC that will be managed by Cloudera Manager for creating and storing principals for the services supported by the cluster.



Note: The `krb5-server` package includes a `logrotate` policy file to rotate log files monthly. To take advantage of this, install the `logrotate` package. No additional configuration is necessary.

2. See the example `kdc.conf` and `krb5.conf` files in in [Sample Kerberos Configuration Files](#) for configuration considerations for the KDC and Kerberos clients.

3. Configure a default Kerberos realm for the cluster you want Cloudera Manager to manage and set up one-way cross-realm trust between the cluster-dedicated KDC and either your central KDC or Active Directory, using the appropriate steps:

- Using a Cluster-Dedicated KDC with a Central MIT KDC
- Using a Cluster-Dedicated MIT KDC with Active Directory

Cloudera strongly recommends the method above because:

- It requires minimal configuration in Active Directory.
- It is comparatively easy to script the creation of many principals and keytabs. A principal and keytab must be created for every daemon in the cluster, and in a large cluster this can be extremely onerous to do directly in Active Directory.
- There is no need to involve central Active Directory administrators to get service principals created.
- It allows for incremental configuration. The Hadoop administrator can completely configure and verify the functionality the cluster independently of integrating with Active Directory.

Using a Cluster-Dedicated KDC with a Central MIT KDC

About this task



Important: If you plan to use Oozie or the Hue Kerberos Ticket Renewer in your cluster, you must configure your KDC to allow tickets to be renewed, and you must configure `krb5.conf` to request renewable tickets. Typically, you can do this by adding the `max_renewable_life` setting to your realm in `kdc.conf`, and by adding the `renew_lifetime` parameter to the `libdefaults` section of `krb5.conf`.

Procedure

1. In the `/var/kerberos/krb5kdc/kdc.conf` file on the local dedicated KDC server host, configure the default realm for the Hadoop cluster by substituting your Kerberos realm in the following realms property:

```
[realms]
HADOOP.EXAMPLE.COM = {
```

2. In the `/etc/krb5.conf` file on all cluster hosts and all Hadoop client user hosts, configure the default realm for the Hadoop cluster by substituting your Kerberos realm in the following realms property. Also specify the local dedicated KDC server hostname in the `/etc/krb5.conf` file (for example, `kdc01.example.com`).

```
[libdefaults]
    default_realm = HADOOP.EXAMPLE.COM
[realms]
    HADOOP.EXAMPLE.COM = {
        kdc = kdc01.hadoop.example.com:88
        admin_server = kdc01.hadoop.example.com:749
        default_domain = hadoop.example.com
    }
    EXAMPLE.COM = {
        kdc = kdc01.example.com:88
        admin_server = kdc01.example.com:749
        default_domain = example.com
    }
[domain_realm]
    .hadoop.example.com = HADOOP.EXAMPLE.COM
    hadoop.example.com = HADOOP.EXAMPLE.COM
    .example.com = EXAMPLE.COM
    example.com = EXAMPLE.COM
```

3. To set up the cross-realm trust in the cluster-dedicated KDC, type the following command in the `kadmin.local` or `kadmin` shell on the cluster-dedicated KDC host to create a `krbtgt` principal. Substitute your cluster-dedicated KDC realm for `HADOOP.EXAMPLE.COM`, and substitute your central KDC realm for `EXAMPLE.COM`. Enter

a trust password when prompted. Note the password because you will need to enter the exact same password in the central KDC in the next step.

```
kadmin: addprinc krbtgt/HADOOP.EXAMPLE.COM@EXAMPLE.COM
```

4. To set up the cross-realm trust in the central KDC, type the same command in the kadmin.local or kadmin shell on the central KDC host to create the exact same krbtgt principal and password.

```
kadmin: addprinc krbtgt/HADOOP.EXAMPLE.COM@EXAMPLE.COM
```



Important: For a cross-realm trust to operate properly, both KDCs must have the same krbtgt principal and password, and both KDCs must be configured to use the same encryption type.

5. To properly translate principal names from the central KDC realm into the cluster-dedicated KDC realm for the Hadoop cluster, configure the Trusted Kerberos Realms property of the HDFS service.
 - a) Open the Cloudera Manager Admin Console.
 - b) Go to the HDFS service.
 - c) Click the Configuration tab.
 - d) Select Scope HDFS (Service Wide) .
 - e) Select Category Security .
 - f) Type Kerberos in the Search box.
 - g) Edit the Trusted Kerberos Realms property to add the name of your central KDC realm. If you need to use more advanced mappings which do more than just allow principals from another domain, you may enter them in the Additional Rules to Map Kerberos Principals to Short Names property.
6. Each of your Hadoop client users must also place this information in their local core-site.xml file. The easiest way to do so is by using the Cloudera Manager Admin Console to generate a client configuration file.
7. Later in this procedure, you will restart the services to have the configuration changes in core-site.xml take effect.

Using a Cluster-Dedicated MIT KDC with Active Directory

About this task

For Cloudera Manager clusters, the openldap-clients package must be installed on the Cloudera Manager Server host before configuring the cluster to use Kerberos for authentication.

On the Active Directory Server

Procedure

1. On the Active Directory server host, type the following command to add the local realm trust to Active Directory:

```
netdom trust HADOOP.EXAMPLE.COM /Domain:EXAMPLE.COM /add /realm /password:TrustPassword
```

2. On the Active Directory server host, type the following command to set the proper encryption type:

Windows 2003 RC2

Windows 2003 server installations do not support AES encryption for Kerberos.

```
ktpass /MITRealmName HADOOP.EXAMPLE.COM /TrustEncryp RC4
```

Windows 2008

```
ksetup /SetEncTypeAttr HADOOP.EXAMPLE.COM <enc_type>
```

Where the <enc_type> parameter can be replaced with parameter strings for AES, DES, or RC4 encryption modes. For example, for AES encryption, replace <enc_type> with AES256-CTS-HMAC-SHA1-96 or AES128-CTS-HMAC-SHA1-96 and for RC4 encryption, replace with RC4-HMAC-MD5.



Important: Make sure that the encryption type you specify is supported on both your version of Windows Active Directory and your version of MIT Kerberos.

On the MIT KDC Server

Procedure

1. In the /var/kerberos/krb5kdc/kdc.conf file on the local dedicated KDC server host, configure the default realm for the Hadoop cluster by substituting your Kerberos realm in the following realms property:

```
[realms]
HADOOP.EXAMPLE.COM = {
```

2. Each of your Hadoop client users must also place this information in their local core-site.xml file. The easiest way to do so is by using the Cloudera Manager Admin Console to generate a client configuration file.
3. On the local MIT KDC server host, type the following command in the kadmin.local or kadmin shell to add the cross-realm krbtgt principal:

```
kadmin: addprinc -e "<keysalt_list>" krbtgt/HADOOP.EXAMPLE.COM@EXAMPLE.COM
```

where the <keysalt_list> parameter specifies the types of keys and their salt to be used for encryption of the password for this cross-realm krbtgt principal. It can be set to AES, or RC4 keytypes with a salt value of :normal. Note that DES is deprecated and should no longer be used. You can specify multiple keysalt types using the parameter in the command above. Make sure that at least one of the encryption types corresponds to the encryption types found in the tickets granted by the KDC in the remote realm. For an example of the values to use, see the examples based on the Active Directory functional domain level, below.

Examples by Active Directory Domain or Forest "Functional level"

Active Directory will, based on the Domain or Forest functional level, use encryption types supported by that release of the Windows Server operating system. It is not possible to use AES encryption types with an AD 2003 functional level. If you notice that DES encryption types are being used when authenticating or requesting service tickets to Active Directory then it might be necessary to enable weak encryption types in the /etc/krb5.conf.

- Windows 2003

```
kadmin: addprinc -e "rc4-hmac:normal" krbtgt/HADOOP.EXAMPLE.COM@EXAMPLE.COM
```

- Windows 2008

```
kadmin: addprinc -e "aes256-cts:normal aes128-cts:normal rc4-hmac:normal" krbtgt/HADOOP.EXAMPLE.COM@EXAMPLE.COM
```



Note: The cross-realm krbtgt principal that you add in this step must have at least one entry that uses the same encryption type as the tickets that are issued by the remote KDC. If there are no matching encryption types, principals in the local realm can successfully access the Hadoop cluster, but principals in the remote realm are unable to.

On All Cluster Hosts

Procedure

1. In the `/etc/krb5.conf` file on all cluster hosts and all Hadoop client user hosts, configure both Kerberos realms. Note that `default_realm` should be configured as the local MIT Kerberos realm for the cluster. Your `krb5.conf` may contain more configuration properties than those demonstrated below. This example is provided to clarify configuration parameters.

```
[libdefaults]
    default_realm = HADOOP.EXAMPLE.COM
[realms]
    EXAMPLE.COM = {
        kdc = dc01.example.com:88
        admin_server = dc01.example.com:749
    }
    HADOOP.EXAMPLE.COM = {
        kdc = kdc01.hadoop.example.com:88
        admin_server = kdc01.hadoop.example.com:749
    }
[domain_realm]
    .hadoop.example.com = HADOOP.EXAMPLE.COM
    hadoop.example.com = HADOOP.EXAMPLE.COM
    .example.com = EXAMPLE.COM
    example.com = EXAMPLE.COM
```

2. Use one of the following methods to properly translate principal names from the Active Directory realm into the cluster-dedicated KDC realm for the Hadoop cluster.
 - Using Cloudera Manager: Configure the Trusted Kerberos realms property of the HDFS service:
 - a. Open the Cloudera Manager Admin Console.
 - b. Go to the HDFS service.
 - c. Click the Configuration tab.
 - d. Select Scope > HDFS (Service Wide)
 - e. Select Category > Security.
 - f. Type Kerberos in the Search box.
 - g. Edit the Trusted Kerberos Realms property to add the name of your central KDC realm. If you need to use more advanced mappings which do more than just allow principals from another domain, you may enter them in the Additional Rules to Map Kerberos Principals to Short Names property.
 - Using the Command Line: Configure the `hadoop.security.auth_to_local` setting in the `core-site.xml` file on all of the cluster hosts. The following example translates all principal names with the realm `EXAMPLE.COM` into the first component of the principal name only. It also preserves the standard translation for the default realm (the cluster realm).

```
<property>
  <name>hadoop.security.auth_to_local</name>
  <value>
    RULE: [1:$1@$0](^.*@EXAMPLE\..COM$)s/^.*(.*@EXAMPLE\..COM$/$1/g
```

```
RULE: [ 2:$1@$0 ] ( ^.*@EXAMPLE\ .COM$ ) s/^ ( .* )@EXAMPLE\ .COM$ / $1/g
DEFAULT
</value>
</property>
```

Integrating MIT Kerberos and Active Directory

How to integrate MIT Kerberos and Active Directory in a Cloudera Manager cluster.

About this task

Several different subsystems are involved in servicing authentication requests, including the Key Distribution Center (KDC), Authentication Service (AS), and Ticket Granting Service (TGS). The more nodes in the cluster and the more services provided, the heavier the traffic between these services and the services running on the cluster.

As a general guideline, Cloudera recommends using a dedicated Active Directory instance (Microsoft Server Domain Services) for every 100-200 nodes in the cluster. However, this is just a loose guideline. Monitor utilization and deploy additional instances as needed to meet the demand.

By default, Kerberos uses UDP for client/server communication which is typically faster at delivering packets than TCP, but does not guarantee delivery. Additionally, using UDP packets that get too large are frequently dropped, as is the case when a user is a member of a large number of groups. To avoid this problem, force Kerberos to use TCP by modifying the Kerberos configuration file (krb5.conf) as follows:

```
[libdefaults]
udp_preference_limit = 1
...
```

This is especially useful if the domain controllers are not on the same subnet as the cluster or are separated by firewalls.

In general, Cloudera recommends setting up the Active Directory domain controller (Microsoft Server Domain Services) on the same subnet as the cluster and never over a WAN connection which results in considerable latency and affects cluster performance.

Troubleshooting cluster operations when Active Directory is being used for Kerberos authentication requires administrative access to the Microsoft Server Domain Services instance. Administrators may need to enable Kerberos event logging on the Microsoft Server KDC to resolve issues.

Deleting Cloudera Manager roles or nodes requires manually deleting the associate Active Directory accounts. Cloudera Manager cannot delete entries from Active Directory.

Related Information

[Mapping Kerberos Principals to Short Names](#)

Integrating MIT Kerberos and Active Directory

About this task

Prior to release 5.1, clusters managed by Cloudera Manager could not integrate directly with a Microsoft Active Directory KDC. Rather, integrating the Cloudera Manager cluster with an Active Directory KDC required the additional setup of a local MIT KDC (local, meaning in the same subnet as the cluster).

The steps below can be used for Cloudera Manager clusters prior to release 5.1, or if the Active Directory KDC cannot be accessed directly for whatever reason. The setup process assumes that:

- An MIT Kerberos KDC is running in the same subnet as the cluster and that a Kerberos REALM is local to the cluster

- A Microsoft Server Active Directory instance (Microsoft Server Domain Services) is running elsewhere on the network, in its own Kerberos realm.

Given these two systems, you can then:

1. Create principals for all services running on the cluster in the MIT Kerberos realm local to the cluster.
2. Set up one-way cross-realm trust from the MIT Kerberos realm to the Active Directory realm, as detailed in “Configuring a Local MIT Kerberos Realm to Trust Active Directory” below.

The result of this setup is that Active Directory principals (users) can authenticate to the cluster without needing service principals.

Configuring a Local MIT Kerberos Realm to Trust Active Directory

On the Active Directory Server

Procedure

1. Add the local realm trust to Active Directory with this command:

```
netdom trust YOUR-LOCAL-REALM.COMPANY.COM /Domain:AD-REALM.COMPANY.COM /
add /realm /passwordt:<TrustPassword>
```

2. Set the proper encryption type with this command:

On Microsoft Windows 2008, 2012, or 2016:

```
ksetup /SetEncTypeAttr YOUR-LOCAL-REALM.COMPANY.COM <enc_type>
```

The `<enc_type>` parameter specifies AES, DES, or RC4 encryption. Refer to the documentation for your version of Windows Active Directory to find the `<enc_type>` parameter string to use.

3. Get and verify the list of encryption types set with this command:

On Microsoft Windows 2008, 2012, or 2016:

```
ksetup /GetEncTypeAttr YOUR-LOCAL-REALM.COMPANY.COM
```



Important: Make sure the encryption type you specify is supported on both your version of Windows Active Directory and your version of MIT Kerberos.

On the MIT KDC Server

Procedure

- Type the following command in the `kadmin.local` or `kadmin` shell to add the cross-realm `krbtgt` principal. Use the same password you used in the `netdom` command on the Active Directory Server.

```
kadmin: addprinc -e "enc_type_list" krbtgt/YOUR-LOCAL-REALM.COMPANY.CO
M@AD-REALM.COMPANY.COM
```

where the `enc_type_list` parameter specifies the types of encryption this cross-realm `krbtgt` principal can support—AES, DES, or RC4. You can specify multiple encryption types using the parameter in the command above,

what's important is that at least one of the encryption types corresponds to the encryption type found in the tickets granted by the KDC in the remote realm. For example:

```
kadmin: addprinc -e "rc4-hmac:normal des3-hmac-sha1:normal" krbtgt/YOUR-LOCAL-REALM.COMPANY.COM@AD-REALM.COMPANY.COM
```



Note: The cross-realm krbtgt principal that you add in this step must have at least one entry that uses the same encryption type as the tickets that are issued by the remote KDC. If no entries have the same encryption type, then the problem you will see is that authenticating as a principal in the local realm will allow you to successfully run Hadoop commands, but authenticating as a principal in the remote realm will not allow you to run Hadoop commands.

On All of the Cluster Hosts

Procedure

1. Verify that both Kerberos realms are configured on all of the cluster hosts. Note that the default realm and the domain realm should remain set as the MIT Kerberos realm which is local to the cluster.

```
[realms]
AD-REALM.CORP.FOO.COM = {
  kdc = ad.corp.foo.com:88
  admin_server = ad.corp.foo.com:749
  default_domain = foo.com
}
CLUSTER-REALM.CORP.FOO.COM = {
  kdc = cluster01.corp.foo.com:88
  admin_server = cluster01.corp.foo.com:749
  default_domain = foo.com
}
```

2. To properly translate principal names from the Active Directory realm into local names within Hadoop, you must configure the `hadoop.security.auth_to_local` setting in the `core-site.xml` file on all of the cluster machines. The following example translates all principal names with the realm `AD-REALM.CORP.FOO.COM` into the first component of the principal name only. It also preserves the standard translation for the default realm (the cluster realm).

a.

```
<property>
  <name>hadoop.security.auth_to_local</name>
  <value>
    RULE: [ 1:$1@$0 ] ( ^.*@AD-REALM\.CORP\.FOO\.COM$ ) s/^ ( .* ) @AD-REALM\.CORP
    \.FOO\.COM$/ $1/g
    RULE: [ 2:$1@$0 ] ( ^.*@AD-REALM\.CORP\.FOO\.COM$ ) s/^ ( .* ) @AD-REALM\.CORP
    \.FOO\.COM$/ $1/g
    DEFAULT
  </value>
</property>
```

For more information about name mapping rules, see “Mapping Kerberos Principals to Short Names”.

Hadoop Users (user:group) and Kerberos Principals

During the Cloudera Manager installation process, several Linux user accounts and groups are created by default. These are listed in the table below. For details of these local Linux user accounts, see the [Overview](#) page of this section. Integrating the cluster to use Kerberos for authentication requires creating Kerberos principals and keytabs for these user accounts.

Table 3: Users and Groups

Component (Version)	Unix User ID	Groups	Functionality
Apache Atlas	atlas	atlas, hadoop	Apache Atlas by default has atlas as user and group. It is configurable
Apache Flink	flink	flink	The Flink Dashboard runs as this user.
Apache HBase	hbase	hbase	The Master and the RegionServer processes run as this user.
Apache HBase Indexer	hbase	hbase	The indexer servers are run as this user.
Apache HDFS	hdfs	hdfs, hadoop	The NameNode and DataNodes run as this user, and the HDFS root directory as well as the directories used for edit logs should be owned by it.
Apache Hive Hive on Tez	hive	hive	The HiveServer2 process and the Hive Metastore processes run as this user. A user must be defined for Hive access to its Metastore DB (for example, MySQL or Postgres) but it can be any identifier and does not correspond to a Unix uid. This is <code>javax.jdo.option.ConnectionUserName</code> in <code>hive-site.xml</code> .
Apache Impala	impala	impala, hive	Impala services run as this user.
Apache Kafka	kafka	kafka	Kafka brokers, mirrorMaker, and Connect workers run as this user.
Apache Knox	knox	knox	Apache Knox Gateway Server runs as this user
Apache Kudu	kudu	kudu	Kudu services run as this user.
Apache Livy	livy	livy	The Livy Server process runs as this user
Apache NiFi	nifi	nifi	Runs as the nifi user
Apache NiFi Registry	nifiregistry	nifiregistry	Runs as the nifiregistry user
Apache Oozie	oozie	oozie	The Oozie service runs as this user.
Apache Ozone	hdfs	hdfs, hadoop	Ozone Manager, Storage Container Manager (SCM), Recon and Ozone Datanodes run as this user.
Apache Parquet	~	~	No special users.
Apache Phoenix	phoenix	phoenix	The Phoenix Query Server runs as this user
Apache Ranger	ranger	ranger, hadoop	Ranger Admin, Usersync and Tagsync services by default have ranger as user and ranger, hadoop as groups. It is configurable.
Apache Ranger KMS	kms	kms	Ranger KMS runs with kms user and group. It is configurable.
Apache Ranger Raz	rangerraz	ranger	Ranger Raz runs with rangerraz user and is part of the ranger group.

Component (Version)	Unix User ID	Groups	Functionality
Apache Ranger RMS	rangerrms	ranger	Ranger RMS runs with rangerrms user and is part of the ranger group.
Apache Solr	solr	solr	The Solr processes run as this user.
Apache Spark	spark	spark	The Spark History Server process runs as this user.
Apache Sqoop	sqoop	sqoop	This user is only for the Sqoop1 Metastore, a configuration option that is not recommended.
Apache YARN	yarn	yarn, hadoop	Without Kerberos, all YARN services and applications run as this user. The LinuxContainerExecutor binary is owned by this user for Kerberos.
Apache Zeppelin	zeppelin	zeppelin	The Zeppelin Server process runs as this user
Apache ZooKeeper	zookeeper	zookeeper	The ZooKeeper processes run as this user. It is not configurable.
Cloudera Manager (all versions)	cloudera-scm	cloudera-scm	Clusters managed by Cloudera Manager run Cloudera Manager Server, monitoring roles, and other Cloudera Server processes as cloudera-scm. Requires keytab file named cmf.keytab because name is hard-coded in Cloudera Manager.
Cruise Control	cruisecontrol	hadoop	The Cruise Control process runs as this user.
HttpFS	httpfs	httpfs	The HttpFS service runs as this user. See “HttpFS authentication” for instructions on how to generate the merged httpfs-http.keytab file.
Hue	hue	hue	Hue services run as this user.
Hue Load Balancer	apache	apache	The Hue Load balancer has a dependency on the apache2 package that uses the apache user name. Cloudera Manager does not run processes using this user ID.
Key Trustee Server	keytrustee	keytrustee	The Key Trustee Server service runs as this user.
Schema Registry	schemaregistry	hadoop	The Schema Registry process runs as this user.
Streams Messaging Manager	streamsmgmgmr	streamsmgmgmr	The Streams Messaging Manager processes runs as this user.
Streams Replication Manager	streamsrepmgr	streamsrepmgr	The Streams Replication Manager processes runs as this user.
Apache Omid	omid	hdfs	

Keytabs and Keytab File Permissions

Linux user accounts, such as hdfs, are mapped to the username portion of the Kerberos principal names, as follows:

```
username/host.example.com@EXAMPLE.COM
```

For example, the Kerberos principal for Apache Hive would be:

```
hive/host.example.com@EXAMPLE.COM
```

Keytabs that contain multiple principals are merged automatically from individual keytabs by Cloudera Manager. If you override a service configuration to not use the CM-provided keytab, then you must ensure that all the principals required for the given role instance on a specific host are merged together in the keytab file you deploy manually on that host.

For example, for Filename (*.keytab), the Atlas keytab filename would be atlas.keytab, HBase would be hbase.keytab, and Cloudera Manager would be cmf.keytab and scm.keytab.

Keytab File Owner:Group matters when Cloudera Manager starts a role. For example, Cloudera Manager starts the role "DataNode". Cloudera Manager launches the DataNode process as a user (here, "hdfs"). Because that process needs to access the HDFS keytab, Cloudera Manager puts the HDFS keytab in the DataNode's process directory, and the keytab is given the owner:group that is listed in the table. Thus, the DataNode process properly owns the keytab file.

The tables below lists the usernames to use for Kerberos principal names, for clusters managed by Cloudera Manager.

Apache Atlas

Role: atlas-ATLAS_SERVER

Kerberos Principals

atlas

Filename (*.keytab)

atlas

Keytab File Owner:Group

atlas:atlas

File Permission (octal)

600

Apache Flink

Role: flink

Kerberos Principals

flink

Filename (*.keytab)

flink

Keytab File Owner:Group

flink:flink

File Permission (octal)

600

Apache HBase

Role: hbase-HBASETHRIFTSERVER

Kerberos Principals

hbase, HTTP

Filename (*.keytab)

hbase, HTTP

Keytab File Owner:Group

hbase:hbase

File Permission (octal)

600

Role: hbase-REGIONSERVER**Kerberos Principals**

hbase, HTTP

Filename (*.keytab)

hbase, HTTP

Keytab File Owner:Group

hbase:hbase

File Permission (octal)

600

Role: hbase-HBASERESTSERVER**Kerberos Principals**

hbase, HTTP

Filename (*.keytab)

hbase, HTTP

Keytab File Owner:Group

hbase:hbase

File Permission (octal)

600

Role: hbase-MASTER**Kerberos Principals**

hbase, HTTP

Filename (*.keytab)

hbase, HTTP

Keytab File Owner:Group

hbase:hbase

File Permission (octal)

600

Apache HBase indexer**Role: ks_indexer-HBASE_INDEXER****Kerberos Principals**

hbase, HTTP

Filename (*.keytab)

hbase

Keytab File Owner:Group

hbase:hbase

File Permission (octal)

600

Apache HDFS**Role: hdfs-NAMENODE****Kerberos Principals**

hdfs, HTTP

Filename (*.keytab)

hdfs

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: hdfs-DATANODE**Kerberos Principals**

hdfs, HTTP

Filename (*.keytab)

hdfs

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: hdfs-SECONDARYNAMENODE**Kerberos Principals**

hdfs, HTTP

Filename (*.keytab)

hdfs

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Apache Hive, Hive on Tez**Role: hive-HIVESERVER2****Kerberos Principals**

hive

Filename (*.keytab)

hive

Keytab File Owner:Group

hive:hive

File Permission (octal)

600

Role: hive-HIVEMETASTORE**Kerberos Principals**

hive

Filename (*.keytab)

hive

Keytab File Owner:Group

cloudera-scm:cloudera-scm

File Permission (octal)

600

Apache Impala**Role: impala-STATESTORE****Kerberos Principals**

impala, HTTP

Filename (*.keytab)

impala

Keytab File Owner:Group

impala:impala

File Permission (octal)

600

Role: impala-CATALOGSERVER**Kerberos Principals**

impala, HTTP

Filename (*.keytab)

impala

Keytab File Owner:Group

impala:impala

File Permission (octal)

600

Role: impala-IMPALAD**Kerberos Principals**

impala, HTTP

Filename (*.keytab)

impala

Keytab File Owner:Group

impala:impala

File Permission (octal)

600

Apache Kafka**Role: kafka-KAFKA_BROKER****Kerberos Principals**

kafka

Filename (*.keytab)

kafka

Keytab File Owner:Group

kafka:kafka

File Permission (octal)

600

Role: kafka-KAFKA_MIRROR_MAKER**Kerberos Principals**

kafka_mirror_maker

Filename (*.keytab)

kafka

Keytab File Owner:Group

kafka:kafka

File Permission (octal)

600

Role: kafka-KAFKA_CONNECT**Kerberos Principals**

kafka

Filename (*.keytab)

kafka

Keytab File Owner:Group

kafka:kafka

File Permission (octal)

600

Apache Knox**Role: knox-KNOX_GATEWAY****Kerberos Principals**

knox, HTTP

Filename (*.keytab)

hbase

Keytab File Owner:Group

knox:knox

File Permission (octal)

600

Apache Kudu**Role: kudu-KUDU_MASTER****Kerberos Principals**

kudu

Filename (*.keytab)

kudu

Keytab File Owner:Group

kudu:kudu

File Permission (octal)

600

Role: kudu-KUDU_TSERVER**Kerberos Principals**

kudu

Filename (*.keytab)

kudu

Keytab File Owner:Group

kudu:kudu

File Permission (octal)

600

Apache Livy**Role:** livy-LIVY_SERVER**Kerberos Principals**

livy

Filename (*.keytab)

livy

Keytab File Owner:Group

livy:livy

File Permission (octal)

600

Apache NiFi**Role:** nifi**Kerberos Principals**

nifi, HTTP

Filename (*.keytab)

nifi

Keytab File Owner:Group

nifi:nifi

File Permission (octal)

600

Apache NiFi Registry**Role:** nifiregistry**Kerberos Principals**

nifiregistry, HTTP

Filename (*.keytab)

nifiregistry

Keytab File Owner:Group

nifiregistry:nifiregistry

File Permission (octal)

600

Apache Oozie**Role:** oozie-OOZIE_SERVER**Kerberos Principals**

oozie, HTTP

Filename (*.keytab)

oozie

Keytab File Owner:Group

oozie:oozie

File Permission (octal)

600

Apache Ozone**Role: ozone-OZONE_MANAGER****Kerberos Principals**

om, HTTP

Filename (*.keytab)

ozone

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: ozone-STORAGE_CONTAINER_MANAGER**Kerberos Principals**

scm, HTTP

Filename (*.keytab)

ozone

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: ozone-OZONE_DATANODE**Kerberos Principals**

dn, HTTP

Filename (*.keytab)

ozone

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: ozone-OZONE_RECON**Kerberos Principals**

recon, HTTP

Filename (*.keytab)

ozone

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Role: ozone-S3_GATEWAY**Kerberos Principals**

HTTP

Filename (*.keytab)

ozone

Keytab File Owner:Group

hdfs:hdfs

File Permission (octal)

600

Apache Phoenix

Role: phoenix-PHOENIX_QUERY_SERVER

Kerberos Principals

phoenix, HTTP

Filename (*.keytab)

phoenix

Keytab File Owner:Group

phoenix:phoenix

File Permission (octal)

600

Apache Ranger

Role: ranger-RANGER_ADMIN

Kerberos Principals

rangeradmin, rangerlookup, HTTP

Filename (*.keytab)

ranger

Keytab File Owner:Group

ranger:ranger

File Permission (octal)

600

Role: ranger-RANGER_USERSYNC

Kerberos Principals

rangerusersync

Filename (*.keytab)

ranger

Keytab File Owner:Group

ranger:ranger

File Permission (octal)

600

Role: ranger-RANGER_TAGSYNC

Kerberos Principals

rangertagsync

Filename (*.keytab)

ranger

Keytab File Owner:Group

ranger:ranger

File Permission (octal)

600

Apache Ranger KMS**Role:** ranger-RANGER_TAGSYNC**Kerberos Principals**

rangerkms, HTTP

Filename (*.keytab)

ranger_kms

Keytab File Owner:Group

kms:kms

File Permission (octal)

600

Apache Ranger Raz**Role:** ranger-RANGER_RAZ**Kerberos Principals**

rangerraz, HTTP

Filename (*.keytab)

rangerraz

Keytab File Owner:Group

ranger:rangerraz

File Permission (octal)

600

Apache Ranger RMS**Role:** ranger-RANGER_RMS**Kerberos Principals**

rangerrms

Filename (*.keytab)

rangerrms

Keytab File Owner:Group

ranger:rangerrms

File Permission (octal)

600

Apache Solr**Role:** solr-SOLR_SERVER**Kerberos Principals**

solr, HTTP

Filename (*.keytab)

solr

Keytab File Owner:Group

solr:solr

File Permission (octal)

600

Apache Spark**Role:** spark_on_yarn-SPARK_YARN_HISTORY_SERVER**Kerberos Principals**

spark

Filename (*.keytab)

spark

Keytab File Owner:Group

spark:spark

File Permission (octal)

600

Apache YARN**Role:** yarn-NODEMANAGER**Kerberos Principals**

yarn, HTTP

Filename (*.keytab)

yarn

Keytab File Owner:Group

yarn:hadoop

File Permission (octal)

644

Role: yarn-RESOURCEMANAGER**Kerberos Principals**

yarn, HTTP

Filename (*.keytab)

yarn

Keytab File Owner:Group

yarn:hadoop

File Permission (octal)

600

Role: yarn-JOBHISTORY**Kerberos Principals**

mapred

Filename (*.keytab)

mapred

Keytab File Owner:Group

yarn:hadoop

File Permission (octal)

600

Apache Zeppelin**Role:** zeppelin-ZEPPELIN_SERVER**Kerberos Principals**

zeppelin, HTTP

Filename (*.keytab)

zeppelin

Keytab File Owner:Group

zeppelin:zeppelin

File Permission (octal)

600

Apache ZooKeeper

Role: zookeeper-server

Kerberos Principals

zookeeper

Filename (*.keytab)

zookeeper

Keytab File Owner:Group

zookeeper:zookeeper

File Permission (octal)

600

Cloudera Management

Role: cloudera-mgmt-REPORTSMANAGER

Kerberos Principals

hdfs

Filename (*.keytab)

headlamp

Keytab File Owner:Group

cloudera-scm:cloudera-scm

File Permission (octal)

600

Role: cloudera-mgmt-SERVICEMONITOR

Kerberos Principals

hue

Filename (*.keytab)

cmon

Keytab File Owner:Group

cloudera-scm:cloudera-scm

File Permission (octal)

600

Role: cloudera-mgmt-ACTIVITYMONITOR

Kerberos Principals

hue

Filename (*.keytab)

cmon

Keytab File Owner:Group

cloudera-scm:cloudera-scm

File Permission (octal)

600

Cloudera Manager**Kerberos Principals**

cloudera-scm, HTTP

Filename (*.keytab)

cmf, scm

Keytab File Owner:Group

cloudera-scm:cloudera-scm

File Permission (octal)

600

CruiseControl**Role: cruise_control-CRUISE_CONTROL_SERVER****Kerberos Principals**

cruisecontrol, kafka, HTTP

Filename (*.keytab)

cruise_control

Keytab File Owner:Group

cruisecontrol:hadoop

File Permission (octal)

600

HttpFS**Role: hdfs-HTTPFS****Kerberos Principals**

httpfs, HTTP

Filename (*.keytab)

httpfs

Keytab File Owner:Group

httpfs:httpfs

File Permission (octal)

600

Hue**Role: hue-KT_RENEWER****Kerberos Principals**

hue

Filename (*.keytab)

hue

Keytab File Owner:Group

hue:hue

File Permission (octal)

600

Schema Registry**Role:** schemaregistry-SCHEMA_REGISTRY_SERVER**Kerberos Principals**

schemaregistry, HTTP

Filename (*.keytab)

schemaregistry

Keytab File Owner:Group

schemaregistry:hadoop

File Permission (octal)

600

Streams Messaging Manager**Role:** streams_messaging_manager-STREAMS_MESSAGING_MANAGER_SERVER**Kerberos Principals**

streamsmmsgmgr, HTTP

Filename (*.keytab)

streams_messaging_manager

Keytab File Owner:Group

streamsmmsgmgr:streamsmmsgmgr

File Permission (octal)

600

Streams Replication Manager**Role:** streams_replication_manager-STREAMS_REPLICATION_MANAGER_DRIVER**Kerberos Principals**

streamsrepmgr

Filename (*.keytab)

streams_replication_manager

Keytab File Owner:Group

streamsrepmgr:streamsrepmgr

File Permission (octal)

600

Role: streams_replication_manager-STREAMS_REPLICATION_MANAGER_SERVICE**Kerberos Principals**

streamsrepmgr

Filename (*.keytab)

streams_replication_manager

Keytab File Owner:Group

streamsrepmgr:streamsrepmgr

File Permission (octal)

600

Apache Omid**Role:****Kerberos Principals**

Filename (*keytab)**Keytab File Owner:Group****File Permission (octal)**

Create Service Principals and Keytab Files for HDP

This section is optional. During the HDP 3.1.5 to HDP intermediate bits upgrade, Ambari can generate the principals and keytabs. However, before upgrading, you can manually generate the principals and keytabs. First, create the principal using mandatory naming conventions and then create the keytab file with the principal's information. Lastly, copy the keytab file to the keytab directory on the appropriate service host.

To create a service principal, use the kadmin utility. The kadmin utility is a command-line driven utility where you can run Kerberos commands to manipulate the central database. To start kadmin, run the following commands:

1. `'kadmin $USER/admin@REALM'`
2. `kadmin: addprinc -randkey $principal_name/$service-host-FQDN@$hadoop.realm`

**Note:**

- a. You must have a principal with administrative permissions to run the above commands.
- b. The randkey is used to generate the password.
- c. The \$principal_name part of the name must match the values in the table below.

In the example mentioned in step 2, each service principal's name is appended with a fully qualified domain name of the host on which the principal is running. This is to provide a unique principal name for services that run on multiple hosts, like DataNodes and TaskTrackers. The addition of the hostname serves to distinguish, for example, a request from DataNode A from a request from DataNode B. This is important for two reasons:

- If the Kerberos credentials for one DataNode are compromised, it does not automatically compromise all other DataNodes.
- If multiple DataNodes have the same principal and are simultaneously connecting to the NameNode, and if the Kerberos authenticator sent has the same timestamp, then the authentication is rejected as a replay request.



Note: The NameNode, Secondary NameNode, and Oozie require two principals each.

If you are configuring High Availability (HA) for a Quorum-based NameNode, you must also generate a principle (jn/\$FQDN) and keytab (jn.service.keytab) for each JournalNode. JournalNode also requires the keytab for its HTTP service. If the JournalNode is deployed on the same host as a NameNode, the same keytab file (spnego.service.keytab) can be used for both. In addition, HA requires two NameNodes. Both the active and standby NameNodes require their own principal and keytab files. The service principals of the two NameNodes can share the same name, specified with the dfs.namenode.kerberos.principal property in hdfs-site.xml, but the NameNodes still have different fully qualified domain names.

Service	Component/Role	Principal Name	Mandatory Keytab Filename
HDFS	NameNode	nn/\$FQDN	nn.service.keytab
	SecondaryNameNode	nn/\$FQDN	nn.service.keytab
	DataNode	dn/\$FQDN	dn.service.keytab
	Journal Server*	jn/\$FQDN	jn.service.keytab
	NameNode HTTP	HTTP/\$FQDN	spnego.service.keytab
	SecondaryNameNode HTTP	HTTP/\$FQDN	spnego.service.keytab
MapReduce	MR2 History Server	jhs/\$FQDN	nm.service.keytab
	MR2 History Server HTTP	HTTP/\$FQDN	spnego.service.keytab
YARN	Node Manager	nm/\$FQDN	nm.service.keytab

Service	Component/Role	Principal Name	Mandatory Keytab Filename
	Resource Manager	rm/\$FQDN	rm.service.keytab
	YARN Timeline Server	yarn-ats/\$FQDN	yarn-ats.service.keytab
	HTTP	HTTP/\$FQDN	spnego.service.keytab
Oozie	Oozie Server	oozie/\$FQDN	oozie..service.keytab
	Oozie HTTP	HTTP/\$FQDN	spnego.service.keytab
Hive	HiverServer2, HMS	hive/\$FQDN	hive.service.keytab
	Hive HTTP	HTTP/\$FQDN	spnego.service.keytab
HBase	HBase Master Server	hbase/\$FQDN	hbase.service.keytab
	HBase RegionServer	hbase/\$FQDN	hbase.service.keytab
Kafka	Kafka Broker	kafka/\$FQDN	kafka.service.keytab
Zeppelin	Zeppelin Server	zeppelin/\$FQDN	zeppelin.service.keytab
Zookeeper		zookeeper/\$FQDN	zk.service.keytab
Knox		knox/\$FQDN	knox.service.keytab
Ranger	Admin Server	rangeradmin/\$FQDN	rangeradmin.service.keytab
	Lookup Server	rangerlookup/\$FQDN	rangerlookup.service.keytab
	KMS	rangerkms/\$FQDN	rangerkms.service.keytab
	UserSync	rangerusersync/\$FQDN	rangerusersync.service.keytab
	TagSync	rangertagsync/\$FQDN	rangertagsync.service.keytab
AMS		amshbase/\$FQDN	ams-hbase.master.keytab
		amsmon/\$FQDN	ams.collector.keytab
		amszk/\$FQDN	ams-zk.service.keytab
Spark2		spark/\$FQDN	spark.service.keytab
Druid		druid/\$FQDN	druid.service.keytab
Infra-Solr		infra-solr/\$FQDN	ambari-infra-solr.service.keytab
Atlas		atlas/\$FQDN	atlas.service.keytab
Livy		livy/\$FQDN	livy.service.keytab

* Only required if you are setting up NameNode HA. For example, to create the principal for a DataNode service, run the command `kadmin: addprinc -randkey dn/$datanode-host@$hadoop.realm`

3. Extract the related keytab file and place it in the keytab directory of the respective components. The default directory is `/etc/krb5.keytab`.

- `kadmin: xst -k $keytab_file_name $principal_name/fully.qualified.domain.name`

You must use the mandatory names for the `$keytab_file_name` variable shown in the table above. For example, to create the keytab files for the NameNode, run the command `kadmin: xst -k nn.service.keytab nn/$namenode-host` `kadmin: xst -k spnego.service.keytab HTTP/$namenode-host`

After creating the keytab files, copy the keytab files to the keytab directory of the respective service hosts.

4. On each service in your cluster, verify that the correct keytab files and principals are associated with the correct service using the `klist` command. For example, on the NameNode, run the command `klist -k -t /etc/security/nn.service.keytab`

Related Information

[Using a custom Kerberos keytab retrieval script](#)

[Customizing Kerberos principals](#)

Mapping Kerberos Principals to Short Names

You configure the mapping from Kerberos principals to short names in the `hadoop.security.auth_to_local` property setting in the `core-site.xml` file. Kerberos has this support natively, and Hadoop's implementation uses Kerberos's configuration language to specify the mapping.

A mapping consists of a set of rules that are evaluated in the order listed in the `hadoop.security.auth_to_local` property. The first rule that matches a principal name is used to map that principal name to a short name. Any later rules in the list that match the same principal name are ignored.

You specify the mapping rules on separate lines in the `hadoop.security.auth_to_local` property as follows:

```
<property>
  <name>hadoop.security.auth_to_local</name>
  <value>
    RULE:[<principal translation>](<acceptance filter>)<short name substitut
ion>
    RULE:[<principal translation>](<acceptance filter>)<short name substituti
on>
    DEFAULT
  </value>
</property>
```



Note: You can also set `auth_to_local` rules in `krb5.conf` using MIT Kerberos. If you do, be aware that the format is different, and the rules described below will fail if used in this context.

Mapping Rule Syntax

To specify a mapping rule, use the prefix string `RULE:` followed by three sections—principal translation, acceptance filter, and short name substitution—described in more detail below. The syntax of a mapping rule is:

```
RULE:[<principal translation>](<acceptance filter>)<short name substitution>
```

Principal Translation

The first section of a rule, `<principal translation>`, performs the matching of the principal name to the rule. If there is a match, the principal translation also does the initial translation of the principal name to a short name. In the `<principal translation>` section, you specify the number of components in the principal name and the pattern you want to use to translate those principal component(s) and realm into a short name. In Kerberos terminology, a principal name is a set of components separated by slash ("/") characters.

The principal translation is composed of two parts that are both specified within "[]" using the following syntax:

```
[<number of components in principal name>:<initial specification of short na
me>]
```

where:

`<number of components in principal name>` – This first part specifies the number of components in the principal name (not including the realm) and must be 1 or 2. A value of 1 specifies principal names that have a single component (for example, `hdfs`), and 2 specifies principal names that have two components (for example, `hdfs/fully.qualified.domain.name`). A principal name that has only one component will only match single-component rules, and a principal name that has two components will only match two-component rules.

<initial specification of short name> – This second part specifies a pattern for translating the principal component(s) and the realm into a short name. The variable \$0 translates the realm, \$1 translates the first component, and \$2 translates the second component.

Here are some examples of principal translation sections. These examples use atm@YOUR-REALM.COM and atm/fully.qualified.domain.name@YOUR-REALM.COM as principal name inputs:

This Principal Translation	Translates atm@YOUR-REALM.COM into this short name	Translates atm/fully.qualified.domain.name@YOUR-REALM.COM into this short name
[1:\$1@\$0]	atm@YOUR-REALM.COM	Rule does not match1
[1:\$1]	atm	Rule does not match1
[1:\$1.foo]	atm.foo	Rule does not match1
[2:\$1/\$2@\$0]	Rule does not match2	atm/fully.qualified.domain.name@YOUR-REALM.COM
[2:\$1/\$2]	Rule does not match2	atm/fully.qualified.domain.name
[2:\$1@\$0]	Rule does not match2	atm@YOUR-REALM.COM
[2:\$1]	Rule does not match2	atm

Footnotes:

1Rule does not match because there are two components in principal name atm/fully.qualified.domain.name@YOUR-REALM.COM

2Rule does not match because there is one component in principal name atm@YOUR-REALM.COM

Acceptance Filter

The second section of a rule, (<acceptance filter>), matches the translated short name from the principal translation (that is, the output from the first section). The acceptance filter is specified in "()" characters and is a standard regular expression. A rule matches only if the specified regular expression matches the entire translated short name from the principal translation. That is, there's an implied ^ at the beginning of the pattern and an implied \$ at the end.

Short Name Substitution

The third and final section of a rule is the (<short name substitution>). If there is a match in the second section, the acceptance filter, the (<short name substitution>) section does a final translation of the short name from the first section. This translation is a sed replacement expression (s/.../.../g) that translates the short name from the first section into the final short name string. The short name substitution section is optional. In many cases, it is sufficient to use the first two sections only.

Converting Principal Names to Lowercase

In some organizations, naming conventions result in mixed-case usernames (for example, John.Doe) or even uppercase usernames (for example, JDOE) in Active Directory or LDAP. This can cause a conflict when the Linux username and HDFS home directory are lowercase.

To convert principal names to lowercase, append /L to the rule.

Example Rules

Suppose all of your service principals are either of the form App.service-name/fully.qualified.domain.name@YOUR-REALM.COM or App.service-name@YOUR-REALM.COM, and you want to map these to the short name string service-name. To do this, your rule set would be:

```
<property>
  <name>hadoop.security.auth_to_local</name>
  <value>
    RULE:[1:$1](App\..*)s/App\..*/$1/g
    RULE:[2:$1](App\..*)s/App\..*/$1/g
```

```

    DEFAULT
  </value>
</property>

```

The first \$1 in each rule is a reference to the first component of the full principal name, and the second \$1 is a regular expression back-reference to text that is matched by (.*) .

In the following example, suppose your company's naming scheme for user accounts in Active Directory is FirstnameLastname (for example, JohnDoe), but user home directories in HDFS are /user/firstnamelastname. The following rule set converts user accounts in the CORP.EXAMPLE.COM domain to lowercase.

```

<property>
  <name>hadoop.security.auth_to_local</name>
  <value>
    RULE:[2:$1@$0](HTTP@QCORP.EXAMPLE.COM\E$)s/@QCORP.EXAMPLE.COM\E$//
    RULE:[1:$1@$0](.*@QCORP.EXAMPLE.COM\E$)s/@QCORP.EXAMPLE.COM\E$///L
    RULE:[2:$1@$0](.*@QCORP.EXAMPLE.COM\E$)s/@QCORP.EXAMPLE.COM\E$///L
    DEFAULT
  </value>
</property>

```

In this example, the JohnDoe@CORP.EXAMPLE.COM principal becomes the johndoe HDFS user.

Default Rule

You can specify an optional default rule called DEFAULT (see example above). The default rule reduces a principal name down to its first component only. For example, the default rule reduces the principal names atm@YOUR-REALM.COM or atm/fully.qualified.domain.name@YOUR-REALM.COM down to atm, assuming that the default domain is YOUR-REALM.COM.

The default rule applies only if the principal is in the default realm.

If a principal name does not match any of the specified rules, the mapping for that principal name will fail.

Testing Mapping Rules

You can test mapping rules for a long principal name by running:

```
hadoop org.apache.hadoop.security.HadoopKerberosName name1 name2 name3
```