Multi-node Installation Guide

Qlik Catalog®

May 2022 rev1

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1.0 Qlik Catalog Overview and System Requirements

This document describes how to install the "multi-node" deployment option for Qlik Catalog. Once the installation is complete, upon first login to the Qlik Catalog application, you will be prompted for a license. A license for "**Qlik Catalog**" must be entered.

1.1 Hardware Configuration Requirements

Cluster Edge Node Recommendations

- Recommended Minimum Production Configuration
  - 12 Cores
  - 128GB RAM
  - System Drive 1TB
  - Data Drive 1TB
  - Ethernet 10GB
  - Virtual Machine or bare metal

- Minimum POC/Dev Configuration
  - 4 Cores
  - 32GB RAM
  - System partition 100GB
  - Data partition 100GB
  - Ethernet 10GB
  - Virtual Machine or bare metal

- Minimum Supported Screen Resolution: 1366x768px

1.2 Software Configuration Requirements & Support Matrix

Qlik Catalog and Qlik Enterprise Manager supported versions

- Qlik Enterprise Manager May 2021 and above
- Qlik Catalog November 2020 Service Release 1 (4.8.1+)

Qlik Catalog and Qlik Sense supported versions

- QSEoW/QSD May 2021
- Qlik Catalog February 2021 Service Release 2 (4.9.2)
- QSEoW/QSD February 2021 (latest patch) and November 2020 (latest patch)
- Qlik Catalog February 2021 Service Release 1 (4.9.1)
- QSEoW/QSD November 2020 patch 3
- Qlik Catalog February 2021 (4.9)

NOTE: Environment should be configured as a true edge node with all relevant Hadoop client tools.

System Requirements	Version
PostgreSQL Metadata Database	Custom Qlik Catalog PostgreSQL 11. Version 11.15 required for first-time installations.
Oracle Metadata Database	Not supported
Apache Tomcat	Tomcat 9. Version 9.0.62+ encouraged for first-time installations.
Java	OpenJDK 8 or JDK 11, minimum version 1.8.0_222
Certified Hadoop Distributions	
Cloudera CDP Private Cloud	7.1.6
AWS EMR	5.33 or 6.5.0 – please request script emr-create-edge-node.sh
Browsers	
Google Chrome	80.0 or higher
MS Internet Explorer	Not supported
Other browsers not actively tested	Issues must be reproducible using Chrome to be eligible for a fix.
Operating Systems	
RHEL/CentOS Linux 7 RHEL 8 Ubuntu 20.04 LTS	CentOS Linux release 7, certified on en_US locale RHEL 7 and RHEL 8 installations require a valid Red Hat entitlement subscription. RHEL 7 installations require access to the following repositories: • rhel-7-server-rpm • rhel-7-server-extras-rpms • rhel-7-server-optional-rpms

Additional Requirements

- ➢ Sqoop version supported by your Hadoop distribution (should naturally be included as part of the edge node)
- ➢ Beeline (should naturally be included as part of the edge node)
- ➢ Hadoop client (should naturally be included as part of the edge node)
- ➢ Kerberos tools (krb5-workstation.x86_64) if Kerberos will be used
- ➢ Apache Phoenix (if Hbase access is needed)
- ➢ All JDBC drivers needed for database connectivity
- ➢ Ensure port 8080 or 8443 (http or https) is open from user desktops to the Qlik Catalog node(s)

2.0 User Setup and Security Prerequisites

Please review this section carefully to determine the user access plan for deploying Qlik Catalog on your Hadoop cluster. There are several nuances that are important to consider up front based on expected usage of the application. For example, in a POC you might not enable all the security components to reduce install complexity, but for production you would enable several of them.

2.1 Cluster User Setup and Impersonation

Qlik Catalog supports Impersonation. Impersonation allows a managed user to login as themselves and execute work on the cluster represented by their user ID using privileges of a service account.

If impersonation is DISABLED:

1. A service user is needed to run Qlik Catalog (the user who is running Tomcat on the edge node) and it should exist on all cluster nodes as an OS user. A group with the same name should also exist -- all permissions granted to the user should also be granted to the group.
2. The Qlik Catalog service user should have ALL access to node manager local directories specified in yarn.nodemanager.local-dirs property in yarn-site.xml
3. The Qlik Catalog service user (and group) should have ALL permissions (rwx) on the podium base directory in HDFS.
4. The Qlik Catalog service user should have a home directory in HDFS (example: /user/qdc) and should have all permissions on it.
5. The Qlik Catalog service user should have all permissions in Hive including create/drop database and create/drop function.
    a. If this is not possible the Hive databases can be created in advance and a property set to allow this to happen vs default behavior which is dynamic databases creation when sources are on-boarded.

If impersonation is ENABLED:

1. All Qlik Catalog users should exist on all cluster nodes as OS users.
2. The Qlik Catalog service user should have ALL access to node manager local directories specified in yarn.nodemanager.local-dirs property in yarn-site.xml
3. All Qlik Catalog users should have all permissions on podium base directory in HDFS. A simple way to do this if Ranger is not being used is to add the user to the service group.
4. All Qlik Catalog users should have a home directory in HDFS (example: /user/username1) and should have all permissions on it.
5. In case the hive.admin.user is specified, it should have all permissions in Hive including create/drop databases and create/drop function. All other Qlik Catalog users should have read permissions on their source tables
    a. NOTE: hive.admin.user (specified in core_env.properties) allows you to override impersonation settings specifically for Hive access
6. In case the hive.admin.user is NOT specified, all Qlik Catalog users should have all permissions in Hive including create/drop databases and create/drop function.

Please see the Ranger section for more details.

2.2 Active Directory

Qlik Catalog can sync with existing users and their groups in AD by specifying the necessary parameters in the Qlik Catalog UI within the admin section. If creating a custom AD group for the POC with associated users, and Ranger is in use, you must create appropriate Ranger policies as well.

Example of information for UI parameters for registering the connection.

```
active_directory_ldap_host=sid.ad.podiumdata.net
active_directory_ldap_port=636
active_directory_ldap_user_dn="CN=Podium Data,DC=ad,DC=podiumdata,DC=net"
active_directory_ldap_user_pw="Qwerty123!"
active_directory_ldap_is_ssl=true
active_directory_ldap_search_base_dn="DC=ad,DC=podiumdata,DC=net"
active_directory_ldap_search_filter="(&(cn=Domain Users)(objectClass=group))"
```

2.3 HDFS and Hive Permissions

Qlik Catalog stores all ingested data in HDFS within a defined taxonomy. The prefix structure can be completely user defined, as well as the named folders Qlik Catalog creates, but Qlik Catalog will create its own structures within those folders. All users who want to run loads, transforms, or publish jobs in Qlik Catalog must have "rwx" access to at least one of the predefined directory structures.

Example:

- /user/defined/directory/for/podium

Within this structure Qlik Catalog will store sources, tables, and field information associated with Hive tables.

- /user/defined/directory/for/podium/receiving/source_name/entity_name/partition_timestamp/

As part of the data on-boarding process, Qlik Catalog will automatically create Hive external tables for the data it copies to HDFS (see above section). If no Hive database exists, Qlik Catalog will dynamically create one as the service user (if impersonation is OFF or if it's explicitly set) or as the username that runs the load job (if impersonation is ON). This can be bypassed if it violates security policy (give the create permissions) by pre-creating Hive databases and setting a parameter in core_env.properties called validate.hive.database=false.

Example Hive JDBC URIs

jdbc:hive2://master.hostname.acme.net:10000/default;principal=hive/master.hostname.acme.net@hostname.acme.net
jdbc:hive2://hdmduv0005.test.group:10010/podium_test_01;principal=hive/hdmduv0005.machine.group@APPGLOBAL.CHIPCORP.COM
jdbc:hive2://hdmduv0005.machine.test.group:10010/podium_test_01;principal=hive/_HOST@APPGLOBAL.CHIPCORP.COM

2.4 Ranger

Qlik Catalog supports Apache Ranger. First, Qlik Catalog will naturally honor Ranger security policies and report any access rights errors up through the Qlik Catalog UI because of its use of Hadoop standard APIs. Second, in the unique scenario where impersonation is enabled, but a service account is used for Hive, Qlik Catalog can dynamically create Ranger policies based on the work done by the service account based on the user executing the work in Qlik Catalog. This is an OPTIONAL capability for this unique security scenario. Please see the Ranger section for more details.

2.5 Kerberos

For an application to use Kerberos, its source code must be modified to make the appropriate calls into the Kerberos libraries. Applications modified in this way are Kerberos-aware or Kerberized. The following will enable Qlik Catalog to run (under Tomcat) as a Kerberized application. Qlik Catalog functionality will be authenticated by Kerberos for the user which has been kinit (obtained/cached Kerberos ticket-granting tickets) before Tomcat is started.

When Kerberos is enabled, Qlik Catalog specifies a set of rules in the property hadoop.security.auth_to_local in core-site.xml that maps Kerberos principals to local OS users. Usually, the rules are configured to just strip the domain names from the principals to get the local user name. Those local users must be OS users on all nodes.
If Kerberos is configured with Active Directory, this process is simplified as the AD users are already available as OS users on all nodes (e.g., `id adccuser` returns the AD user/group).

- Ensure Java Cryptography Extension (JCE) unlimited security jars are up to date. They are provided with OpenJDK, but not with Oracle JDK. JCE is automatically included and enabled with Java 8u162 or above.
- Optimal Kerberos properties for single realm include ticket lifecycle and encryption. Add the following properties to: krb5.conf dns_lookup_kdc = false dns_lookup_realm = false
- Multi realm settings are supported.

Please see 5.2 Kerberos Configuration appendix section for more details.

3.0 Installation Prerequisites

The prerequisite software need only be installed before a first-time Catalog installation, not an upgrade. There is also no requirement to upgrade prerequisites (e.g., Tomcat or PostgreSQL) when upgrading Catalog.

NOTE: In all commands below, the user that the command should be "executed as" is in parentheses at the beginning of the line:

- "(sudo)" means the command should be run as a user with sudo permission
- "(qdc)" means the command should be run as the Qlik Catalog *service account* user -- "sudo su - qdc" may be used to become this user
- "(postgres)" means the command should be run as the PostgreSQL superuser -- "sudo su - postgres" may be used to become this user

Note: Outside ports 80/8080 (HTTP) and 443/8443 (HTTPS) must be opened to allow outbound communication to the Internet in order to allow software to be downloaded.

Prerequisite Installation Script (strongly encouraged)

There is an optional prerequisite installation script which may be used to install the prerequisite packages described in this section. It's use is strongly encouraged. It will automatically download and configure all required prequisite software, including Java, Tomcat and PostgreSQL. Further, it will automatically configure Tomcat for HTTPS.

It is located within the QDCinstaller.zip package and is named ***QDCprereqs.sh***.

- '**sudo'** permission is required to run *QDCprereqs.sh*
- There are two environment variables at the beginning of the script which may be defined by end-users:
  - **QDC_HOME**: the directory where Qlik Catalog will be installed. (default value: /usr/local/qdc)
  - **QDC_SERVICE_ACCOUNT**: the local user account which will be used to run Qlik Catalog. (default value: qdc)
- RHEL 7/8 installations require a valid Red Hat entitlement subscription. This prerequisite script will not run without a subscription.

To run *QDCprereqs.sh*:

1. Install unzip (if not present)

   RHEL 7/8 & CentOS 7 Deployments

   (sudo) # sudo yum install -y unzip

   Ubuntu 20.04 Deployments

   (sudo) # sudo apt install -y unzip

2. Copy the QDCinstaller.zip file into an installer "working" directory (example: /tmp)

   Example: (**sudo**) # cp QDCinstaller.zip /tmp

3. Unzip QDCinstaller.zip

   (**sudo**) # cd /tmp
   (**sudo**) # unzip QDCinstaller.zip

4. Copy the podium zip file into the QDCinstaller directory created in Step 3

   Example: (**sudo**) # cp podium-4.14-xxxxx.zip /tmp/QDCinstaller/

5. Run QDCprereqs.sh

   (**sudo**) # cd /tmp/QDCinstaller
   (**sudo**) # ./QDCprereqs.sh

6. After QDCprereqs.sh has been run successfully you may skip to Section 4.1 First Time Installation Using the Installer

Manual Prerequisite Installation

Important: During the prerequisite setup process, several items are needed from the Qlik Catalog software distribution, podium-4.14-xxxxx.zip. The instructions below assume the Qlik Catalog software distribution has been unzipped to /tmp:

1. Install unzip (if not present)

   RHEL 7/8 & CentOS 7 Deployments

   (sudo) # sudo yum install -y unzip

   Ubuntu Deployments

   (sudo) # sudo apt install -y unzip

2. Expand the Qlik Catalog software distribution to /tmp

   (sudo) # unzip <replace-path>/podium-4.14-xxxxx.zip -d /tmp/

3.1 Java JDK Installation

Qlik Catalog is supported on the following JDK platforms:

- OpenJDK 8
- OpenJDK 11
- Oracle JDK 8 (license required)

1. Check if JDK exists. If a correct version exists, skip this step.

   (sudo) # java -version

JDK 8 results:

```
Openjdk version "1.8.0_222"
OpenJDK Runtime Environment (build 1.8.0_222-b10)
OpenJDK 64-Bit Server VM (build 25.222-b10, mixed mode)
```

JDK 11 results:

```
openjdk version "11.0.6" 2020-01-14 LTS
OpenJDK Runtime Environment 18.9 (build 11.0.6+10-LTS)
OpenJDK 64-Bit Server VM 18.9 (build 11.0.6+10-LTS, mixed mode, sharing)
```

2. JDK Installation:
   - ➔ OpenJDK: Use package manager for installation:

OpenJDK 8 installation:

RHEL 7/8 & CentOS 7 Deployments

(sudo) # sudo yum install -y java-1.8.0-openjdk-devel

Ubuntu Deployments

(sudo) # sudo apt install -y openjdk-8-jdk

OpenJDK 11 installation:

RHEL 7/8 & CentOS 7 Deployments

(sudo) # sudo yum install -y java-11-openjdk-devel

Ubuntu Deployments

(sudo) # sudo apt install -y openjdk-11-jdk

➔ **Oracle JDK 8 (license required): Download the package directly from Oracle and install.**

3.2 Create Service Account and Qlik Catalog Directory

Create a ***service account*** to run Qlik Catalog. Tomcat will be started as this user. Typically, this user is named “qdc” or “qdcsvc”. Throughout the remainder of this document “qdc” will be used -- please replace “qdc” with a different user if so desired. In a similar fashion, “qdc” is also used as a group name.

1. Create a service account to run Qlik Catalog (the user which launches Tomcat)

(sudo) # sudo groupadd qdc
(sudo) # sudo useradd -s /bin/bash -g qdc qdc

Additional step for Ubuntu deployments:

(sudo) mkdir /home/qdc && chown qdc:qdc /home/qdc

2. Optionally, set a password for the service account - this is not needed if “sudo” is used to become this user (e.g., “sudo su - qdc”)

   (sudo) # sudo passwd qdc

3. Create a directory for all Qlik Catalog artifacts, including Tomcat

   (sudo) # sudo mkdir /usr/local/qdc

4. Change ownership of /usr/local/qdc to the service account and group being used

   (sudo) # sudo chown -Rf qdc:qdc /usr/local/qdc

3.3 Tomcat Installation

Qlik Catalog is only supported on Tomcat version 9. Version 9.0.62+ is encouraged for first-time installs. There is no requirement to upgrade Tomcat when upgrading Catalog. If needed, Tomcat upgrade instructions are included elsewhere in this guide.

Qlik strongly encourages the use of SSL with Tomcat for securing Qlik Catalog sessions. Instructions for configuring Tomcat to support SSL connections are provided later in this document.

1. Install wget (if not present) while a sudo capable user

   RHEL 7/8 & CentOS 7 Deployments

   (sudo) # sudo yum install -y wget

   Ubuntu Deployments

   (sudo) # sudo apt install -y wget

2. Become the service account user

   (sudo) # sudo su - qdc

3. Download Apache Tomcat 9.0.62+

   (qdc) $ cd /usr/local/qdc
   (qdc) $ wget https://archive.apache.org/dist/tomcat/tomcat-9/v9.0.62/bin/apache-tomcat-9.0.62.tar.gz

4. Extract the Tomcat file

   (qdc) $ tar -xvf apache-tomcat-9.0.62.tar.gz

5. The resulting directory, for example “/usr/local/qdc/apache-tomcat-9.0.62”, is known as the Tomcat home directory. When configuring the QDCinstaller.properties file in the next section, please set TOMCAT_HOME to this value.

6. Overwrite <tomcat home>/conf/server.xml with the version expanded from the Qlik Catalog zip file or edit the existing server.xml manually.

Overwrite Instructions (recommended)

(qdc) $ cp /tmp/podium/config/tomcat9-server.xml /usr/local/qdc/apache-tomcat-9.0.62/conf/server.xml

OR

Manual Edit Instructions:

In the HTTP Connector element, add the bold attributes to turn compression on

```
<Connector port="8080" protocol="HTTP/1.1"
        connectionTimeout="20000"
        useSendfile="false"
        compression="on"
        compressionMinSize="150"
        noCompressionUserAgents="gozilla, traviata"
        compressibleMimeType="text/html,text/xml,text/plain,text/css,text/javascript,application/javascript,application/json,application/xml"
        redirectPort="8443" />
```

In the AccessLogValve element, change the bold attributes prefix, suffix and pattern

```
<Valve className="org.apache.catalina.valves.AccessLogValve" directory="logs"
        prefix="localhost_access" suffix=".log"
        pattern="%h %l %u %t &amp;quot;%r&amp;quot; %s %b %{podiumUser}s %{podiumSession}s [%l]" />
```

7. Port 8080 needs to be open on the Qlik Catalog node firewall for HTTP connections. Port 8443 needs to be opened on the Qlik Catalog node firewall for secure HTTPS connections.

   ➔ It is recommended that Tomcat be configured to ***redirect*** insecure HTTP connections directly to a secure HTTPS session. Instructions for configuring **HTTPS redirect** are provided later in this document.

RHEL 7/8 & CentOS 7 Deployments

```
(sudo)  # sudo firewall-cmd --zone=public --permanent --add-port=8080/tcp
(sudo)  # sudo firewall-cmd --zone=public --permanent --add-port=8443/tcp
(sudo)  # sudo systemctl restart firewalld.service
```

Ubuntu Deployments (if UFW firewall is enabled)

```
(sudo)  # sudo ufw allow 8080,8443/tcp
```

8. Setup Apache Tomcat as a service to automatically start when Linux restarts

   Possible edit: if the Tomcat home directory is not /usr/local/qdc/apache-tomcat-9.0.62 or the service user/group is not qdc, the file /etc/systemd/system/tomcat.service must be edited after the copy (cp) step below.

   The copy (cp) command below assumes the Qlik Catalog software (a.k.a., podium zip) has been expanded to /tmp -- see Section 3.0. You will not be able to

start the service until Qlik Catalog PostgreSQL is later installed, as a dependency exists.

(sudo) # sudo cp /tmp/podium/config/tomcat.service /etc/systemd/system/
(sudo) # sudo systemctl daemon-reload
(sudo) # sudo systemctl enable tomcat.service

9. Optional: Configure Tomcat to support HTTPS (see later section)

   Configuring Tomcat to support HTTPS may be done now or later.

10. Start Tomcat manually

    (qdc) $ cd <tomcat home>
    (qdc) $ ./bin/startup.sh

11. Browse to the following URL to verify that Tomcat is running

    http://<Qlik-Catalog-Node-IP-Address-OR-Hostname>:8080

12. Tomcat can be manually stopped at any time

    (qdc) $ cd <tomcat home>
    (qdc) $ ./bin/shutdown.sh

13. The Tomcat log can be monitored

    (qdc) $ tail -F <tomcat home>/logs/catalina.out

3.4 PostgreSQL Installation

Qlik Catalog is certified on Qlik Catalog PostgreSQL 11, a customized version of PostgreSQL that supports long schema and table names. First-time Catalog installations must install Qlik Catalog PostgreSQL 11.15. There is no requirement to upgrade PostgreSQL when upgrading Catalog. If needed, PostgreSQL upgrade instructions are included elsewhere in this guide.

To ensure this version is used, the Qlik Catalog PostgreSQL installer has been included in the Qlik Catalog zip file. The directions below describe how to extract and install this custom version of PostgreSQL, and then configure it.

Do **NOT** install PostgreSQL using rpm, yum or otherwise download it from the Internet.

NOTE: If you already have a different version of PostgreSQL installed, please first uninstall it.

NOTE: The below instructions assume that the Qlik Catalog zip file has already been extracted to /tmp -- see Section 3.0.

1. Create a “postgres” user and group

   (sudo) # sudo groupadd postgres
   (sudo) # sudo useradd -s /bin/bash -g postgres postgres

Additional step for Ubuntu deployments:
(sudo) # sudo mkdir /home/postgres && chown postgres:postgres /home/postgres

2. Add the “postgres” user to the “qdc” group

   (sudo) # sudo usermod -aG qdc postgres

3. Create directories for executables and data, and change their ownership

   (sudo) # sudo mkdir -p /usr/pgsql/qdc11-15
   (sudo) # sudo chown -R postgres:postgres /usr/pgsql
   (sudo) # sudo mkdir -p /var/lib/pgsql/11-15/qdc_data
   (sudo) # sudo chown -R postgres:postgres /var/lib/pgsql

4. Run the custom Qlik Catalog PostgreSQL installer appropriate for your operating system as the “postgres” user:

   (sudo) # sudo su - postgres

   Installer for RHEL7/CentOS7 deployments**:**

   (postgres) $ /tmp/podium/thirdParty/qdc_pg11-15_RHEL7-and-CentOS7.bsx

   Installer for RHEL8/CentOS8 deployments:

   (postgres) $ /tmp/podium/thirdParty/qdc_pg11-15_RHEL8-and-CentOS8.bsx

   Installer for Ubuntu 20.04 deployments:

   (postgres) $ /tmp/podium/thirdParty/qdc_pg11-15_Ubuntu.bsx

5. Create symlinks to executables

   (sudo) # sudo ln -s /usr/pgsql/qdc11-15/bin/psql /usr/bin/psql
   (sudo) # sudo ln -s /usr/pgsql/qdc11-15/bin/pg_dump /usr/bin/pg_dump
   (sudo) # sudo ln -s /usr/pgsql/qdc11-15/bin/pg_restore /usr/bin/pg_restore

6. IMPORTANT! Port 5432 needs to be opened on the Qlik Catalog node firewall to allow connections to PostgreSQL. The Qlik Licenses container is dependent upon communication with the PostgreSQL database.

   RHEL 7/8 & CentOS 7 Deployments

   (sudo) # sudo firewall-cmd --zone=public --permanent --add-port=5432/tcp

   (sudo) # sudo systemctl restart firewalld.service

   Ubuntu Deployments

   (sudo) # sudo ufw allow 5432/tcp

7. Set PostgreSQL to start automatically, then start it.

   Possible edit: if the directories in step 3 were altered, or the user/group is not “postgres”, the file /etc/systemd/system/qdc_pg.service must be edited after the copy (cp) step below.

The copy (cp) command below assumes the Qlik Catalog software (a.k.a., podium zip) has been expanded to /tmp -- see Section 2.0.

(sudo) # sudo cp /tmp/podium/config/qdc_pg.service /etc/systemd/system/
(sudo) # sudo systemctl daemon-reload
(sudo) # sudo systemctl enable qdc_pg.service
(sudo) # sudo systemctl start qdc_pg.service

3.5 Container Platform & Node.js

Qlik Catalog requires a container platform to run containers. Platform is determined by the operating system upon which Catalog is deployed:

CentOS 7: *Docker Community Edition*

RHEL7: *Docker Enterprise*

RHEL8 & Ubuntu 20.04: *Podman*

Node.js is required for integration with Qlik Sense.

1. Install Node.js (which includes npm)

RHEL 7/8 & CentOS 7 Deployments

(sudo) # curl -sL https://rpm.nodesource.com/setup_14.x | sudo bash -
(sudo) # sudo yum install -y nodejs

Ubuntu Deployments

(sudo) # curl -sL https://deb.nodesource.com/setup_14.x | sudo -E bash -
(sudo) # sudo apt install -y nodejs

2. Install Container Platform

CentOS 7 Deployments: *Docker Community Edition* (CE)

Docker CE installation instructions for CentOS 7

Install Docker, set it to start automatically, and start it:

(sudo) # sudo yum install -y yum-utils device-mapper-persistent-data lvm2
(sudo) # sudo yum-config-manager --add-repo
https://download.docker.com/linux/centos/docker-ce.repo
(sudo) # sudo yum install -y docker-ce

(sudo) # sudo systemctl enable docker.service
(sudo) # sudo systemctl start docker.service

RHEL 7 Deployments: *Docker Enterprise*

- *Docker Enterprise* is the officially supported Docker platform for RHEL 7.
- A support subscription with Red Hat Software is required to access the RHEL repository containing the Docker Enterprise engine.
- Official RHEL 7 Docker Enterprise installation instructions may be found here: https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux_atomic_host/7/html-single/getting_started_with_containers/index#using_the_docker_command_and_service

Docker Enterprise installation instructions for RHEL 7

1. Install Docker, set it to start automatically, and start it:

(sudo) # subscription-manager repos --enable=rhel-7-server-rpms
(sudo) # subscription-manager repos --enable=rhel-7-server-extras-rpms
(sudo) # subscription-manager repos --enable=rhel-7-server-optional-rpms

(sudo) # yum install docker device-mapper-libs device-mapper-event-libs
(sudo) # systemctl enable docker.service
(sudo) # systemctl start docker.service

(sudo) # groupadd docker
(sudo) # chown -R root:docker /run/docker /etc/sysconfig/docker /etc/docker /var/lib/docker /usr/bin/docker /usr/share/bash-completion/completions/docker /usr/libexec/docker
(sudo) # chmod -R 770 /var/lib/docker

(sudo) # systemctl restart docker.service

2. Add the service user to the “docker” group

(sudo) # sudo usermod -aG docker qdc

3. Install Docker Compose

(sudo) sudo curl -L "https://github.com/docker/compose/releases/download/1.23.2/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose

```
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   617  100   617    0     0   2114      0 --:--:-- --:--:-- --:--:--  2127
100 11.2M  100 11.2M    0     0  13.9M      0 --:--:-- --:--:-- --:--:-- 32.9M
```

(sudo) # sudo chmod +x /usr/local/bin/docker-compose

4. Test Docker and Docker Compose -- this should be done as the service account user

(sudo) # sudo su - qdc

(qdc) $ docker ps

```
CONTAINER ID    IMAGE    COMMAND    CREATED    STATUS    PORTS    NAMES
```

(qdc) $ docker-compose version

```
docker-compose version 1.23.2, build 1110ad01
docker-py version: 3.6.0
CPython version: 3.6.7
OpenSSL version: OpenSSL 1.1.0f  25 May 2017
```

RHEL 8 Deployments: *Podman*

- *Podman* is the officially supported container platform for RHEL 8.
- *Podman* is a "daemonless" container platform

Podman installation instructions for RHEL 8

(sudo) # yum module install -y container-tools

Test Podman command as service account user

(sudo) # sudo su - qdc

(qdc) $ podman info

Ubuntu 20.04 Deployments: *Podman*

- *Podman* is the supported container platform for Ubuntu 20.04 deployments.
- *Podman* is a "daemonless" container platform

Podman installation instructions for Ubuntu 20.04

(sudo) # apt install curl gnupg2 -y

(sudo) # echo 'deb http://download.opensuse.org/repositories/devel:/kubic:/libcontainers:/stable/xUbuntu_20.04/ /' > /etc/apt/sources.list.d/devel:kubic:libcontainers:stable.list

(sudo) # wget -nv https://download.opensuse.org/repositories/devel:kubic:libcontainers:stable/xUbuntu_20.04/Release.key -O- | apt-key add -

(sudo) # apt-get update -qq -y

(sudo) # apt-get -qq --yes install podman

Test Podman command as service account user

(sudo) # sudo su - qdc

(qdc) $ podman info

3.6 Create Qlik Catalog Base Storage Directory in HDFS

Note: If you have not already read section 2.1 “Cluster User Setup” please do so now.

The following operations should be performed by the owner of the cluster directory (usually ‘hdfs’) or user who is a member of the cluster ‘supergroup.’

1. Qlik Catalog requires a base directory to work from in HDFS. You can specify any base directory and Qlik Catalog will create sub-directories from there.

   # hadoop fs -mkdir /podiumbase

2. Change ownership of <qlik catalog base directory> to the *service account* running Qlik Catalog. Both the service account user and group should have "rwx" access to the Catalog base directory:

   # hadoop fs -chown -R <service user>:<service group> /podiumbase

```
[qdc]$ hadoop fs -ls /
Found 6 items
drwxr-xr-x   - hive hive                0 2020-07-17 10:43 /hive
drwxrwxr-x   - qdc  qdc                 0 2021-08-05 11:26 /podiumbase
drwxrwxrwt   - hdfs supergroup          0 2021-08-05 14:15 /tmp
drwxr-xr-x   - hdfs supergroup          0 2021-07-23 17:58 /user
drwxr-xr-x   - hdfs supergroup          0 2020-07-17 10:43 /warehouse
drwxr-xr-x   - yarn hadoop              0 2020-07-17 10:43 /yarn
```

3. On all nodes in the cluster:
   1) create a user & group with the same name as the Catalog service account
   2) add user 'hive' to the service account group

   Example:

```
#  adduser qdc
#  usermod -aG hive qdc
```

4. Verify hive membership to service account group from Catalog node:

```
[qdc]$ hdfs groups hive
hive : hive qdc
```

5. When new files and directories are created under /podiumbase, both user and group qdc must have "rwx" access. This can be done using HDFS ACLs. First change any existing files and directories. Then, set the default for all future files and directories. Do this as owner or 'superuser' of hadoop cluster (e.g., 'hdfs'):

```
[qdc]$ sudo su - hdfs
Last login: Fri Jul 23 17:57:30 EDT 2021 on pts/0

[hdfs]$ hadoop fs -setfacl -m -R group:qdc:rwx /podiumbase

[hdfs]$ hadoop fs -setfacl -m -R default:group:qdc:rwx /podiumbase
```

   https://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-common/FileSystemShell.html#setfacl

3.7 Create Hive 'user_views' Database

This database is used as ‘transient scratch space’ for Publishing data from Qlik Catalog to an external target. Views are dynamically created when data needs to be masked/obfuscated with the appropriate function required in order to land the data in the required state. This database can be any name and is set in the core_env.properties file.

- Log into Hive and create a database called 'user_views'. Ensure that the Hive/Podium user has full permissions for the 'user_views' database.

  # create database user_views;

3.8 EMR Deployments Only: Setup Edge Node

The Qlik Catalog AWS EC2 instance must be configured as an "edge node" to interact with the EMR cluster. The process is detailed in Section 5.6.1, and a sample shell script has been included to facilitate edge node setup. *Edge node setup should be completed prior to running the Qlik Catalog installer in Section 4*.

4.0 Qlik Catalog Software Installation

The Qlik Catalog installer is a shell script, ***QDCinstaller.sh***, that is guided by a properties file containing configuration, ***QDCinstaller.properties***. The same properties file can be used both for the initial install as well as later upgrades.

The shell script and properties files are included in a zip file, **QDCinstaller.zip**. Required installation parameters are first configured in the properties file. Then, the shell script is run and begins by confirming the installation parameters.

Password Encryption

Passwords may be encrypted at any time using a utility. It will use stdin to prompt for the password and output the encrypted password to stdout.

```
# unzip -j podium-4.14-xxxxx.zip podium/lib/podium-encrypt-util.jar -d .
# java -cp podium-encrypt-util.jar com.nvs.core.utils.PodiumEncrUtil
```

NOTE: In all commands below, the user that the command should be "executed as" is in parentheses at the beginning of the line:

- "(sudo)" means the command should be run as a user with sudo permission
- "(qdc)" means the command should be run as the Qlik Catalog service account user -- "sudo su - qdc" may be used to become this user
- "(postgres)" means the command should be run as the PostgreSQL superuser -- "sudo su - postgres" may be used to become this user

4.1 First-time Installation Using the Installer

Execute the following steps to perform a first-time install:

1. The installer must be run as the Qlik Catalog service account:

   (sudo) # sudo su - qdc

2. Unzip QDCinstaller.zip into a working directory

3. Copy the Qlik Catalog software zip file (e.g., podium-4.14-xxxxx.zip) into the working directory

4. Change directory to the working directory. It should contain the following:

   podium-4.14-xxxxx.zip QDCinstaller.properties QDCinstaller.sh QDCinstaller.txt QCA.txt upgrade-scripts (directory)

5. Edit the installation parameters in **QDCinstaller.properties** -- additional documentation is present in that file. Ensure the following are set -- the defaults should work for most. PODIUM_RELEASE_FILE is set to the current podium zip file. SUPERUSER_NAME and SUPERUSER_PASSWORD are for QDC PostgreSQL and by default are both "postgres":

   - INSTALL_TYPE -- **CDP or EMR**

- ⊄ QDC_HOME
- ⊄ TOMCAT_HOME
- ⊄ PODIUM_RELEASE_FILE
- ⊄ WEBAPP_NAME
- ⊄ POSTGRES_HOSTNAME
- ⊄ POSTGRES_IPADDRESS -- programmatically initialized to local IP address; override if necessary
- ⊄ CATALOG_IPADDRESS -- likely same as POSTGRES_IPADDRESS
- ⊄ SUPERUSER_NAME
- ⊄ SUPERUSER_PASSWORD
- ⊄ JAVA_HOME
- ⊄ PODIUM_BASE -- change this to a path in HDFS (or S3) to which the service user has write permission
- ⊄ If the install is CDP or EMR, set DISTRIBUTION_URI to the Hive JDBC URI if known
- ⊄ If the install is EMR, set BASE_URI, BASE_URI_USERNAME and BASE_URI_PASSWORD as suggested in the comments
- ⊄ If PostgreSQL will be hosted on a different server, set CREATE_PODIUM_MD_DATABASE=false

6. Interactive & Non-Interactive installation modes:

   The Qlik Catalog installer shell script may be run in interactive mode or non-interactive “silent” mode.

   Interactive installation allows users to confirm installer actions in a step-by-step manner. To run the installer in interactive mode simply run: ./QDCinstaller.sh

   Non-Interactive or “silent” installation allows users to deploy QDC in a scripted manner which does not require any user interaction. Details for running the installer in non-interactive mode are noted later in this document.

7. Run the shell script. You may abort the script at any time by entering control-C. The installer will begin by asking you to confirm the data you entered in QDCinstaller.properties -- it will also validate the parameters. It will expand the Qlik Catalog software zip and create all necessary configuration files. It will then setup the database (if PostgreSQL is used).

   (qdc) # ./QDCinstaller.sh

8. When complete, Tomcat is automatically started. It may be started and shutdown using the following:

   (qdc) # <tomcat home>/bin/startup.sh
   (qdc) # <tomcat home>/bin/shutdown.sh

   The log can be viewed as follows:

   (qdc) # tail -F <tomcat home>/logs/catalina.out

9. Open a browser and go to the following URL to validate that you can display the homepage. If a WEBAPP_NAME other than “qdc” was specified in QDCinstaller.properties, please replace “qdc” with the alternative webapp name.

http://<QDC node hostname or IP address>:8080/qdc

10. Attempt to login for the first time (user: podium, password: nvs2014!) and a prompt will appear to enter a license key. Enter the provided key and click register.

4.1.1 Post-Installation Tasks

The installer deployed four containers which are used by Qlik Catalog:

- Licenses
- Engine
- DCAAS
- Data Rest Connector

These containers should be configured to **auto-start during system boot**. (In fact, the Licenses container MUST be running in order to login to Qlik Catalog).

A **post-installation script** which simplifies the process of configuring the containers to run as services is included, and its use is strongly encouraged. It is located within the QDCinstaller.zip package and is named ***QDCpostinstall.sh***:

There are two environment variables at the beginning of the script which may be defined by end-users:

- **QDC_HOME**: the directory where Qlik Catalog has been installed. (default value: /usr/local/qdc)
- **QDC_SERVICE_ACCOUNT**: the local user account which is used to run Qlik Catalog. (default value: qdc)

NOTE: '**sudo'** permission is required to run *QDCpostinstall.sh*

To run *QDCpostinstall.sh*:

1. Switch to a user account with 'sudo' privileges

2. Navigate to the QDCinstaller working directory (used above to run the Catalog installer)

   Example: $ cd /tmp/QDCinstaller

3. Modify variables if non-default location and/or service account was used during installation.

   Example: $ sudo vi QDCpostinstall.sh

4. Run QDCpostinstall.sh using an account with 'sudo'

   (sudo) $ sudo ./QDCpostinstall.sh

Manual Container Service Configuration

If you did not run QDCpostinstall.sh, the Qlik Licenses container must be setup as a service to automatically start when Linux restarts.

IMPORTANT:

a) If the Qlik Catalog Qlik Sense integration directory is not /usr/local/qdc/qlikcore or the service user/group is not "qdc," the file **/etc/systemd/system/qlikContainers.service** must be edited after the copy (cp) step below

b) If deploying to RHEL 8 or Ubuntu 20.04 which use Podman to manage containers you must edit **/etc/systemd/system/qlikContainers.service** after the copy (cp) step below:

   a. REMOVE line 13 completely:

      Requires=docker.service

   b. EDIT line 14 and remove the following text: docker.service

The copy (cp) command below assumes the Qlik Catalog software zip has been expanded to /tmp -- see the prerequisites section.

(sudo) # sudo cp /tmp/podium/config/qlikContainers.service /etc/systemd/system/
(sudo) # sudo systemctl daemon-reload
(sudo) # sudo systemctl enable qlikContainers.service

Congratulations! Qlik Catalog software installation is now complete.

If your cluster uses any combination of Kerberos, SAML, Impersonation or Active Directory, please refer to each section that relates to these topics for configuration. Note: You'll need to sync Active Directory users first before enabling Kerberos to ensure that users registered in Qlik Catalog are authorized to login.

The installer created the Qlik Catalog metadata database (podium_md). The default user (role) for this database is podium_md, with a default password of "nvs2014!".

Important Notes

- Any **JDBC drivers** for your licensed RDBMS should be placed in the directory called out by the following core_env property. This directory is preferred over placing drivers in $TOMCAT_HOME/webapps/qdc/WEB-INF/lib, where they will be overwritten on upgrade and where they may interfere with other libraries.

```
# An alternate directory to WEB-INF/lib for JDBC driver jars.
# May also be set directly, for a given driver, on table
# podium_core.pd_jdbc_source_info, column alt_classpath.
# Restart required. Default: not set
jdbc.alternate.classpath.dir=/usr/local/qdc/jdbcDrivers
```

- If a JDBC driver is particularly complicated and consists of multiple jars (e.g., the Simba Google Big Query driver has dozens of jars), it can be further isolated into its own sub-directory. If you do this, you must run a SQL statement as follows (default password is “nvs2014!”; **update** path and name):

  ```
  psql podium_md -U podium_md -c "update podium_core.pd_jdbc_source_info set alt_classpath =
  '/usr/local/qdc/jdbcDrivers/simbaBigQuery' where sname = 'BIGQUERY';"
  ```

- When running Qlik Catalog multi-node, the expectation is that all cluster configuration is found on the classpath generated by executing ‘hadoop classpath’. Typically, a directory like /etc/hadoop/conf is at the front of the classpath and it contains files like core-site.xml.

No Hadoop configuration files should be placed in the Qlik Catalog WEB-INF/classes directory, nor should symlinks be created from WEB-INF/classes to *-site.xml files elsewhere.

Do not add any libraries from the Hadoop ecosystem, including Hive classes and the Hive JDBC jar, to the classpath, unless directed to do so by Qlik personnel.

REMINDER: Reboot Procedure

When the Qlik Catalog server is restarted, several required processes must be started.

The following are **autostarted** services. To manually restart these services:

- PostgreSQL: (sudo) # sudo systemctl restart qdc_pg.service
  - test: (sudo) # psql
- RHEL7/CentOS 7 Deployments using Docker:
  - (sudo) # sudo systemctl restart docker.service
  - test: (sudo) # sudo docker ps

The following should be **autostarted** services, if configured correctly above. To manually restart these services:

- Qlik Licenses & Engine Containers:
  (sudo) # sudo systemctl restart qlikContainers.service

  Check for Running Containers:
  - *Docker*:
    (sudo) # sudo docker inspect -f '{{.State.Running}}' qlikcore_qix-engine_1
    (sudo) # sudo docker inspect -f '{{.State.Running}}' licenses

  - *Podman*:
    (qdc) $ podman inspect -f '{{.State.Running}}' catalog-pod-engine
    (qdc) $ podman inspect -f '{{.State.Running}}' catalog-pod-licenses

- Tomcat: (sudo) # sudo systemctl restart tomcat.service

If the following were not configured to be autostarted services, they must be manually restarted after reboot. First, become the service user: (sudo) # sudo su - qdc

- Qlik Licenses & Engine Containers: (qdc) $ cd /usr/local/qdc/qlikcore && ./launch_qlikContainers.sh

- Test using *Docker*:
  (qdc) $ docker inspect -f '{{.State.Running}}' qlikcore_qix-engine_1
  (qdc) $ docker inspect -f '{{.State.Running}}' licenses

- Test using *Podman*:
  (qdc) $ podman inspect -f '{{.State.Running}}' catalog-pod-engine
  (qdc) $ podman inspect -f '{{.State.Running}}' catalog-pod-licenses

∉ Tomcat: (qdc) $ /usr/local/qdc/apache-tomcat-9.0.62/bin/startup.sh

4.2 PostgresSQL Manual Database Creation

When “psql” is present on the edge node, the installer will perform a variant of the below actions. **Only perform these actions manually if the installer could not create the Podium metadata database in PostgreSQL** or if the database is located on a different server.

1. Connect to PostgreSQL as **superuser** and create the Qlik Catalog database role:

```
$ psql template1 -U postgres -c "create role podium_md” with encrypted password 'input-new-role-password-here' createdb login;"
```

2. Connect to PostgresSQL as **podium_md** user and create the Qlik Catalog metadata database and schema

```
$ psql template1 -U podium_md -c "create database podium_md;"

$ psql podium_md -U podium_md -c "create schema podium_core;"
```

3. Initialize Qlik Catalog metadata tables in the above database schema

```
$ unzip -j podium-4.14-xxxxx.zip podium/config/core_ddl.txt -d /tmp/

$ psql podium_md -U podium_md -f /tmp/core_ddl.txt
```

4.3 Upgrade of Qlik Catalog

NOTE: Beginning with Qlik Catalog May 2021, **Apache Tomcat 9 is mandatory**. Prior installations using Tomcat 7 must be migrated. The installer will disallow use of any version of Tomcat other than version 9. Please see the section "Migrating to or Upgrading Tomcat 9". Notably, at the end, the installer should be run **WITHOUT** the upgrade option “-u”. Please review the release notes and the below guidance before proceeding.

You should re-use the QDCinstaller.properties file from the initial install, updating the value for PODIUM_RELEASE_FILE.

The installer script has an upgrade mode, which also performs a backup of the WEB-INF/classes directory. Execute the following steps to perform an upgrade of Qlik Catalog June 2019 and later:

1. The installer must be run as the Qlik Catalog service account:

   (sudo) # sudo su - qdc

2. Stop Tomcat. Ensure it is no longer running.

   (qdc) # cd <tomcat home>
   (qdc) # ./bin/shutdown.sh
   (qdc) # ps -ef | grep Boot

3. **Backup** any manually copied Java library jars from <tomcat home>/webapps/qdc/WEB-INF/lib.

4. **Backup** the PostgreSQL database, in case the upgrade must be reverted.

   (sudo) # pg_dump -U postgres --format=c --file=<backupFileName> podium_md

5. Unzip QDCinstaller.zip into a working directory

6. Copy the Qlik Catalog software zip file (podium-4.14-xxxxx.zip) into the working directory

7. Change directory to the working directory. It should contain the following:

   podium-4.14-xxxxx.zip QDCinstaller.properties QDCinstaller.sh QDCinstaller.txt QCA.txt upgrade-scripts (directory)

8. Edit the installation parameters in QDCinstaller.properties -- additional documentation is present in that file

   - Only the following are used for upgrade: INSTALL_TYPE, QDC_HOME, TOMCAT_HOME, PODIUM_RELEASE_FILE, WEBAPP_NAME, POSTGRES_HOSTNAME, POSTGRES_IPADDRESS, CATALOG_IPADDRESS, and database SUPERUSER_NAME and SUPERUSER_PASSWORD.

9. Run the shell script **with the "-u" argument**. You may abort the script at any time by entering control-C. The installer will begin by asking you to confirm the data you entered in QDCinstaller.properties -- it will also validate the parameters. It will expand the Qlik Catalog software zip and update the webapp. A **backup** of WEB-INF/classes is automatically made in <tomcat home>/backups. The file WEB-INF/classes/log4j.xml (or log4j2.xml) is automatically restored during upgrade.

   (qdc) # ./QDCinstaller.sh -u

10. **Restore** any manually copied Java library jars to <tomcat home>/webapps/qdc/WEB-INF/lib. If files were restored, restart Tomcat.

11. The Qlik Licenses container must be setup as a service to automatically start when Linux restarts.

    Possible edit: If the Qlik Catalog Qlik Sense integration directory is not /usr/local/qdc/qlikcore or the service user/group is not qdc, the file

/etc/systemd/system/qlikContainers.service must be edited after the copy (cp) step below.

The copy (cp) command below assumes the Qlik Catalog software (a.k.a., podium zip) has been expanded to /tmp -- the prerequisites section.

(sudo) # sudo cp /tmp/podium/config/qlikContainers.service /etc/systemd/system/
(sudo) # sudo systemctl daemon-reload
(sudo) # sudo systemctl enable qlikContainers.service

12. If previously using the QVD Import feature then **remove the existing *qlikcore.service* file**. The Qlik Engine container required for the QVD Import feature has been included in the unified *qlikContainers.service* file configured in step 11.

    (sudo) # sudo rm /etc/systemd/system/qlikcore.service

4.4 Non-Interactive ("Silent") Installation

Note: If upgrading from a Catalog version prior to 4.7 non-interactive mode is not allowed by the installer due to mandatory upgrade scripts which must be run manually.

To run the installer in non-interactive mode:

2. Edit the installation parameters in **QDCinstaller.properties** -- additional documentation is present in that file. Ensure the following are set -- the defaults should work for most. PODIUM_RELEASE_FILE is set to the current podium zip file. The properties SUPERUSER_NAME and SUPERUSER_PASSWORD are for Qlik Catalog PostgreSQL and by default are both "postgres".
   - INSTALL_TYPE -- **SINGLE**
   - QDC_HOME
   - TOMCAT_HOME
   - PODIUM_RELEASE_FILE
   - WEBAPP_NAME
   - POSTGRES_HOSTNAME
   - POSTGRES_IPADDRESS
   - CATALOG_IPADDRESS
   - SUPERUSER_NAME
   - SUPERUSER_PASSWORD
   - JAVA_HOME
   - PODIUM_BASE

3. the following options must be specified following the QDCinstaller.sh command:

   - -s (silent)
   - -a (Accept Qlik Customer Agreement)

   Example: ./QDCinstaller.sh -s -a

NOTE: Invoking the "-a" option indicating acceptance of the Qlik Customer Agreement (QCA) is required to run the installer in silent mode. By selecting this installation option the user agrees to the following:

BY DOWNLOADING, INSTALLING, OR OTHERWISE USING QLIK PRODUCTS, THE CUSTOMER ACKNOWLEDGES AND AGREES THAT THE USE OF ALL QLIK PRODUCTS IS SUBJECT TO THE TERMS AND CONDITIONS OF THE QLIK CUSTOMER AGREEMENT (QCA) FOUND ON https://qlik.com. ANY SUCH USE WILL CONSTITUTE CUSTOMER'S ACCEPTANCE AND RESULT IN A BINDING AND LEGALLY ENFORCEABLE AGREEMENT BETWEEN THE CUSTOMER AND THE QLIK ENTITY IDENTIFIED IN TABLE 1 OF THE AGREEMENT ("QLIK"). IF YOU ACCEPT THESE TERMS ON BEHALF OF ANY CORPORATION, PARTNERSHIP, OR OTHER ENTITY, YOU REPRESENT AND WARRANT THAT YOU ARE AUTHORIZED TO LEGALLY BIND SUCH ENTITY TO THIS AGREEMENT AND SUCH ENTITY IS DEEMED THE CUSTOMER HEREUNDER.

1. Tomcat.

4.5 Distribution Specific Configuration Parameters

4.5.1 Cloudera Private Cloud (CDP) Configuration

4.5.1.1 Tez Configuration

Prepare using Tez has been tested (in addition to local-mode and MapReduce).

1. Copy Tez to an HDFS folder (here the directory being used is the product base directory (aka podium.base in core_env.properties):

```
# hadoop fs -copyFromLocal /opt/cloudera/parcels/CDH/lib/tez/tez.tar.gz
hdfs://<NAME_SERVICE>:8020/<PODIUM_BASE_DIR>/
```

2. Specify the full path of Tez assembly archive in core_env.properties:

```
tez.lib.uris=hdfs://<NAME_SERVICE>:8020/< PODIUM_BASE_DIR >/tez.tar.gz
```

4.5.1.2 Hive User Defined Functions (UDFs) Configuration

Hive, used for queries and Publish, requires acess to Catalog user defined functions (UDFs).

1. Copy qdc-hudf-<VERSION>.jar to an HDFS folder (here the directory being used is the product base directory (aka podium.base in core_env.properties):

```
# hadoop fs -copyFromLocal <TOMCAT_HOME>/webapps/qdc/WEB-INF/lib/qdc-hudf-
<VERSION>.jar hdfs://<NAME_SERVICE>:8020/<PODIUM_BASE_DIR>/
```

2. Specify the full path of hudf archive in core_env.properties:

```
podium.hive.udf.jar.location=hdfs://<NAME_SERVICE>:8020/<PODIUM_BASE_DIR>/qdc-hudf-
4.14.jar
```

5.0 Qlik Catalog Software Installation Reference

All following sections are not part of the base installation runbook and as such are treated in isolation.

The **core_env.properties** file contains all the primary and secondary configuration parameters necessary for desired operation. The file is found at <tomcat home>/conf/core_env.properties. It is self-describing in that the explanation for all parameters is included in the file itself. Please see the file and modify the parameters as needed. Once Qlik Catalog is launched, you can edit the file and then use the button in the admin section to refresh core_env.properties if any changes are made, which prevents having to restart Tomcat for these changes.

5.1 Masking and Obfuscation

The Qlik Catalog code performing masking and obfuscation must be placed in a directory accessible to the cluster, as well as any needed dictionary files.

1. Define or use an existing HDFS location for the .jar file and dictionary files that enable the data masking/obfuscation capability. This must be a location all users, or the service user that runs on the cluster, have access to. Example:

   ```
   # hadoop fs -mkdir /apps/podium
   ```

2. Copy qdc-hudf-<VERSION>.jar and any dictionary files to the directory you created above.

   ```
   # hadoop fs -put US_census_first_names.txt /apps/podium/
   # hadoop fs -put <tomcat home>/webapps/podium/WEB-INF/lib/qdc-hudf-<VERSION>.jar
   /apps/podium/qdc-hudf-<VERSION>.jar
   ```

3. Open core_env.properties and modify the following properties that reference the file and directory above

   ```
   podium.hive.udf.jar.location=hdfs://apps/podium/qdc-hudf-<VERSION>.jar
   podium.obfuscation.dictionary.hdfs.path=hdfs://apps/podium/
   ```

5.2 Kerberos Configuration

When kerberos is enabled, Qlik Catalog specifies a set of rules in the property hadoop.security.auth_to_local in core-site.xml that maps kerberos principals to local OS users. Theoretically a customer can map all kerberos principals to a few fixed OS users that already exist but normally its not done. Usually, the rules are configured to just strip the domain names from the principals to get the local user name. Those local users must be OS users on all nodes. If kerberos is configured with Active Directory, this process is simplified as the AD users are already available as OS users on all nodes (e.g., `id adccuser` returns the AD user/group).

5.2.1 Running Qlik Catalog in a Kerberized Environment

1. Create a service account for the Qlik Catalog application on all nodes in the cluster as well as the Qlik Catalog nodes. Example: Qlik Catalog. This user, as well as all other users who will execute work through Qlik Catalog if impersonation is enabled, must exist on all nodes and be part of appropriate access right groups and aligned with Ranger policies.

2. Create a Qlik Catalog principal and principals for all users who need access if impersonation will be turned on.

3. Make sure user home directories exist on HDFS for all accounts

4. Make sure HDFS directory ownership and access rights align via policies for the users who will be accessing them.

5. Install Kerberos workstation on the Qlik Catalog server

   # sudo yum install -y krb5-workstation.x86_64

6. Ensure these files are listed in the core_env.properties file in the hadoop.conf.files property

   hadoop.conf.files=core-site.xml,hdfs-site.xml,mapred-site.xml,yarn-site.xml,ssl-client.xml

7. If SSL is enabled also copy the hadoop.truststore file from the cluster to the Qlik Catalog classes folder on the Qlik Catalog node. If SSL is not enabled, skip this step.

   Podium classpath folder
   <tomcat home>/webapps/podium/WEB-INF/classes

8. Generate a Qlik Catalog keytab file on the cluster from kadmin.local command line. Use norand to prevent a new random password from being generated.

   xst -kt -norand podium

9. Copy the keytab file that was just created to the Qlik Catalog server. It will have been created in the local directory where kadmin.local was started.

10. On the Qlik Catalog server, make podium.keytab read-only for the Qlik Catalog user

11. Modify the Qlik Catalog core_env.properties file to include the JDBC URI for Hive as Kerberos Authentication

    jdbc:hive2://master.hostname.acme.net:10000/default;principal=hive/master.hostname.acme.net@hostname.acme.net

    jdbc:hive2://hdmduv0005.machine.test.group:10010/podium_test_01;principal=hive/hdmduv0005.machine.test.group@APPGLOBAL.CHIPCORP.COM

    jdbc:hive2://hdmduv0005.machine.test.group:10010/podium_test_01;principal=hive/_HOST@APPGLOBAL.CHIPCORP.COM

12. On the Qlik Catalog server kinit as the service account

    kinit podium-kt podium.keytab

13. Start Qlik Catalog as the service account

14. Add kinit to crontab for lease refresh

    crontab -e

    - 0 0,5,10,15,20 * * * kinit podium -kt /home/podium/podium.keytab

15. Add kinit to the .bash_profile for the service user

    kinit podium -kt /home/podium/podium.keytab

TIP: The klist command will provide details of who the user is kinited as. To get the exact Hive realm user for the jdbc connection url in core_env; run kadmin.local on the kerberos server and execute listprincs example: kadmin.local:listprincs

kadmin.local is only going to work if the user is logged in to the actual kerberos server
once logged into the kerberos server via kadmin.local OR remotely using kadmin, user can export keytabs with the following syntax:

    xst -kt <keytab-file-name> -norandkey user@KERBEROS.REALM

example: xst -kt podium.keytab -norandkey podium@NAME.REALM
if using kadmin utility remotely, a user would need to be logged in w/ admin permission to export keytabs

```
[root@nemo-kdc-a ~]# kadmin.local
Authenticating as principal root/admin@NEMO.REALM with password.
kadmin.local:  xst -kt podium.keytab -norandkey podium@NEMO.REALM
Entry for principal podium@NEMO.REALM with kvno 3, encryption type aes256-cts-hmac-sha1
-96 added to keytab WRFILE:podium.keytab.
Entry for principal podium@NEMO.REALM with kvno 3, encryption type aes128-cts-hmac-sha1
-96 added to keytab WRFILE:podium.keytab.
kadmin.local:
```

extracted keytab will be located in whatever directory you ran the kadmin command from:

```
kadmin.local:  exit
[root@nemo-kdc-a ~]# ls
anaconda-ks.cfg     hdfs-nemo-nn-b.keytab  kafka.keytab          oozie-http.keytab
bruce-hdfs.keytab   hdfs-nn-a.keytab       ks-post.log           oozie.keytab
cobbler.ks          hive.keytab            ks-post-nochroot.log  podium.keytab
hdfs.keytab         http.keytab            ks-pre.log
[root@nemo-kdc-a ~]#
```

5.2.2 Using Kerberos to Authenticate as a Qlik Catalog User

Kerberos provides transitive authentication—the client authenticates once, and when he requests subsequent services the servers are aware of, prior authentication is extended to those services. A Kerberos user is automatically authenticated in Qlik Catalog as long as the username is the same in both applications and the local Qlik Catalog user has a valid Qlik Catalog group association.

Ensure Java Cryptography Extension (JCE) unlimited security jars are up to date on your system:
US_export_policy.jar
local_policy.jar

They can be downloaded from:
http://www.oracle.com/technetwork/java/javase/downloads/jce8-download-2133166.html

5.2.2.1 Enable Kerberos in core_env.properties

The following properties are used to enable Kerberos for UI (or API) logon.

```
# Authentication modes (case-insensitive): PODIUM, KERBEROS, SAML, NONE (no authentication
# required). This is for authenticating access to the Qlik Catalog server (UI or API). Default: PODIUM
authentication.mode=KERBEROS

# Kerberos realm / Active Directory domain name. This is appended to the username entered into
# the login page. For legacy reasons, it is the same name as the Java system property above.
java.security.krb5.realm=QLIK_SECURE.COM
```

Debug should be enabled when a user faces an issue, this property is enabled for the application to run/generate logs, otherwise the log files will unnecessarily log all details of operations being executed.

```
debug=false
```

Optimal Kerberos properties for single realm including ticket lifecycle and encryption.
Add the following properties to: krb5.conf

```
dns_lookup_kdc = false
dns_lookup_realm = false
ticket_lifetime = 86400 (user-defined)
renew_lifetime = 604800 (user-defined)
forwardable = true
default_tgs_enctypes = aes256-cts-hmac-sha1-96(user-defined)
default_tkt_enctypes = aes256-cts-hmac-sha1-96(user-defined)
permitted_enctypes = aes256-cts-hmac-sha1-96(user-defined)
udp_preference_limit = 1
useFirstPass=true
doNotPrompt=true
```

5.2.2.2 Kerberos: Setting Up Cross Realm Authentication

To allow users with the same username to sign on from a different realm in the same company, comment out the following property in Qlik Catalog core.env:
another.realm.username.pattern=^([A-Za-z0-9]+)([._-]([0-9A-Za-z_-]+))*@([A-Za-z0-9]+)([.]([0-9A-Za-z]+))*([.]([A-Za-z0-9]+){2,4})$

5.2.2.3 Configuring Publish for Target HDFS (Cross Realm)

All name nodes and node managers for Source cluster and Target cluster need the following lines added to /etc/krb5.conf
(default Kerberos config file):

target-nn-a.corp.podiumdata.com = <PRINCIPAL>
target-cloudera.corp.podiumdata.com = <PRINCIPAL>

<sourceclustername>-nn-a.corp.<mycompany>.com=<REALMNAME>
<sourceclustername>-nn-b.corp.<mycompany>.com=<REALMNAME>
<sourceclustername>-cloudera.corp.<mycompany>.com=<REALMNAME>

5.3 Impersonation Configuration

Impersonation support enables Qlik Catalog running as a ServiceUser with executive access to all commands and directories to execute tasks/run jobs on the cluster on behalf of a logged in user in a secured way. Hence Any permissions or privileges as applicable for that user (via Ranger or similar tools) are honored. When impersonation is enabled:

The user logged in to Qlik Catalog will be the user impersonated by ServiceUser (for all interactions with cluster including MapReduce jobs, HDFS operations etc.) User authentication (when logging into Qlik Catalog) will be performed using Kerberos.

5.3.1 Cluster Configuration Requirements

Configuring Hadoop to Allow Impersonation By Creating Proxy Users

To allow ServiceUser to impersonate, the following settings must be configured in core-site.xml. For the following example, assume that ServiceUser is 'podium'. The value * can be used for 'any':

hadoop.proxyuser.podium.hosts==(machine hosts from which proxy/impersonation is allowed)
hadoop.proxyuser.podium.groups==(user groups that can be proxied/impersonated)

example:
hadoop.proxyuser.podium.groups==group1,group2
hadoop.proxyuser.podium.hosts==domain1.mycompany.net, domain2.mycompany.net
hadoop.proxyuser.podium.hosts==67.186.188.83,67.186.188.91-98

(hadoop.proxyuser.<serviceuser>.hosts accepts IP address lists and IP address ranges in CIDR format and/or host names)

If the cluster uses a KMS, modify the following properties for your environment, adding these properties in the KMS configuration
(kms-site.xml) to enable impersonation.

Note: you must remove **ServiceUser** from the below properties and substitute in the service account name used as a proxy user for impersonation.

```
<property>
<name>hadoop.kms.proxyuser.ServiceUser.users</name>
<value>*</value>
</property>
<property>
<name>hadoop.kms.proxyuser.ServiceUser.groups</name>
<value>*</value>
</property>
<property>
<name>hadoop.kms.proxyuser.ServiceUser.hosts</name>
<value>*</value>
</property>
```

5.3.3 Configuring Ranger to Allow Impersonation

If Apache Ranger is configured for Hive, the following additional requirements must be met before loading data:

1. Ranger policies should be created for all users/groups in the application— these groups of users are the OS or Active Directory groups that a Kerberos user belongs to.
2. Individual roles should be given permissions on the Hive database for the sources users will load data to.
3. Set the flag hive.server2.enable.doAs=false in hive-site.xml in Ambari [If old property hive.server2.enable.impersonation is in Ambari, remove it] -- Impersonation is enabled through core_env properties (enable.impersonation=true)
4. If users are allowed to create sources in Qlik Catalog, either the users should be given CREATE permission in Ranger for all databases (asterisk * selects ALL) or the Hive database should first be created by the ServiceUser and then the permission to insert data should be granted to other users.
5. Add hdfs and hive users to wildcard policies defined in hdfs and hive ranger services.

5.3.4 Qlik Catalog Settings to Enable Impersonation

Set the following property in core_env.properties to enable impersonation:

```
enable.impersonation=true
```

When impersonation is enabled, Hive Principal property must be set (modify to environment):

jdbc:hive2://domain.corp.mycompany.com:1000/default;principal=hive/domaincorp.mycompany.com@MYCOMPANY_SECURE.COM

If the environment is not Kerberized (unusual for most clients) , the older url form and username/pw properties are set where the user executing the operations will be the one specified in username property:

distribution.uri=jdbc:hive2://domain.mycompany.com:10000/default
distribution.username=#0{VbhLwQqs3SgU86cJSIhA/w==}
distribution.password=#0{BKWujXAJ1nE6txneNeHdXw==}

5.3.5 User Rep (ServiceUser) Running Qlik Catalog Processes

The User running the Qlik Catalog process (referred to as ServiceUser at places) and hence performing impersonation on the cluster must have rights to proxy other users.
See above (Configuring Hadoop to Allow Impersonation By Creating Proxy Users**)**
The ServiceUser must have valid Kerberos credentials to be able to impersonate another user.

5.3.6 Users Logging into Qlik Catalog (requirements)

Users logged into Qlik Catalog must be valid Kerberos users and hence known to the cluster. Qlik Catalog allows a mix of local and AD/Kerberos-based users. However if a local user tries to perform a cluster operation and impersonation is enabled for that Qlik Catalog install, those operations may fail if the user is not known to the cluster.

5.3.7 Enabling Hive Service id for DDL Operations

Set the following property to run Hive DDL statements as admin user (in the following example, admin user is 'cruser') as opposed to running them as logged in user:

example:
hive.admin.user=cruser

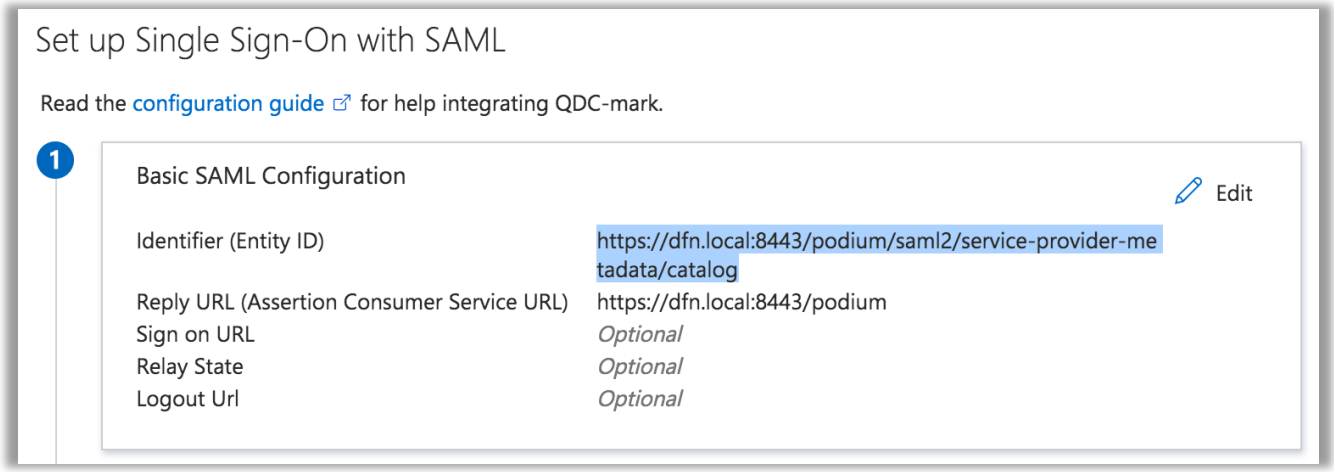
5.4 Enabling SAML

5.4.1 Enabling SAML using Microsoft Azure Active Directory (MS AAD)

(1) Qlik Catalog Tomcat must first be configured for HTTPS (see section below).

(2) Two properties must be set in the MS AAD “Single Sign-On with SAML” “Basic SAML Configuration” dialog – replace <HOSTNAME> with the Qlik Catalog hostname:

- **Identifier (Entity ID)** – https://<HOSTNAME>:8443/qdc/saml2/service-provider-metadata/catalog
- **Reply URL** – https://<HOSTNAME>:8443/qdc



(3) The following three core_env properties must be set (see notes immediately following):

```
authentication.mode=SAML

# this will log out of Qlik Catalog and MS AAD
# replace <tenant-id> and <HOSTNAME> (and possibly 8443 and qdc)
logout.url=https://login.windows.net/<tenant-
id>/oauth2/logout?post_logout_redirect_uri=https%3A%2F%2F<HOSTNAME>%3A8443%2Fqdc%
2Flogged-out

# replace <tenant-id> and <app-id>
saml.metadata.provider=https://login.microsoftonline.com/<tenant-
id>/federationmetadata/2007-06/federationmetadata.xml?appid=<app-id>
```

Notes on core_env properties:

- property "saml.metadata.provider" is taken from MS AAD setup, "**App Federation Metadata Url**"
- property "logout.url" was formerly "saml.logout.url" – it applies to both manually initiated logout via the menu, as well as session timeout
- property "logout.url", when configured for login.windows.net, now supports "post_logout_redirect_uri" to allow redirection from MS back to the Catalog logged-out page
- property "saml.entity.baseurl" is no longer set (May 2021 change)
- property "saml.keystore.path" is no longer set, and there is no longer a need to download the Base64 Certificate and add it to samlKeystore.jks – in fact, samlKeystore.jks is no longer present (May 2021 change)
- do **NOT** copy "**Logout URL**" from MS AAD into the core_env property "logout.url"
- there are only two valid choices for “logout.url”: /logged-out (log out of only Qlik Catalog) or https://login.windows.net/<tenant-id>/oauth2/logout (log out of MS AAD and Qlik Catalog)
- **IMPORTANT**: when logging in to the UI, use URL "https://<HOSTNAME>:8443/qdc" and not "https://<HOSTNAME>:8443/qdc/login"

5.4.2 Enabling SAML using Okta

Instructions below are a reference with examples. Modifications will be required for client specific SAML authentication and client environment. In this example setup, ***Okta*** is used as the Identity Provider (IDP) while podium is the Service Provider (SP).

1. Log in to your Okta organization as a user with administrative privileges. You can create a free Okta Developer Edition organization with your own email here: https://www.okta.com/developer/signup/.
2. Click on the blue Admin button on the top right corner.
3. Click on the Add Applications shortcut in the right panel.
4. Click on the green Create New **App** button.
5. In the dialog that opens, select the **SAML 2.0** option, then click the green **Create** button
6. In Step 1 General Settings, enter the application name (e.g., HostName SAML Application) in App name field, then click the green Next button.
7. In Step 2 Configure SAML, paste the URL below into the “Single Sign On URL" field – replace <HOSTNAME> with the Qlik Catalog hostname:

   https://<HOSTNAME>:8443/qdc

   Then, paste the URL below into the “Audience URI (SP Entity ID)” [old] or “Audience Restriction” [new] field:

   https://<HOSTNAME>:8443/qdc/saml2/service-provider-metadata/catalog

   Then, check the box “Allow this app to request other SSO URLs” and paste the URL below into the “Requestable SSO URLs” field:

   https://<HOSTNAME>:8443/qdc/login/saml2/sso/catalog
8. In Step 3 Feedback click the checkbox next to the text This is an internal application that we created then click the green **Finish** button.
9. You will now see the Sign On section of your newly created Spring Security SAML application
10. Copy the Identity Provider metadata link and paste it in the core_env.properties saml.metadata.provider. Example:

    saml.metadata.provider=https://dev-248822.okta.com/app/exk2z8xylfcOt2tRg4x7/sso/saml/metadata
11. You can also add additional users in the **People** section. All these users will need to be added to podium application as well with the same username.
12. Open the core_env.properties and add this line to it. authentication.mode=SAML
13. Restart the Qlik Catalog application (Tomcat).

There are now two ways to log into Qlik Catalog using Okta SAML Provider:

1. Log in to https://<HOSTNAME>:8443/qdc as usual. It will redirect you to Okta IDP from where you will have to authenticate using username/password. After successful authentication it will redirect to qdc.

   Important! A user with the same username must previously exist in Qlik Catalog.

2. Log in to your Okta account and on the home page, click on the application icon you just created. This will login to the Qlik Catalog application using the account you signed in with. If in the admin console, use the “My end user dashboard” from the top-right corner.

5.5 Tomcat SSL Configuration

Configure Tomcat to Support SSL (HTTPS)

NOTE: As of the May 2022 release, if the optional prerequisites script QDCprereqs.sh is used, Tomcat is ***automatically configured for HTTPS*** (including the generation of a self-signed certificate), and requests on port 8080 are automatically redirected to 8443.

The following steps are for customers that did not use the May 2022 (or more recent) QDCprereqs.sh script.

1. **Generate Keystore** - Use 'keytool' command to create a self-signed certificate. Optionally change the password from "changeit".

   Example:
   (qdc) # keytool -genkey -noprompt -validity 3650 -alias qdc -keyalg RSA -dname 'CN=Qlik Catalog,O=Qlik Technologies Inc.' -ext SAN=DNS:$(hostname) -ext EKU:c=serverAuth -keystore /usr/local/qdc/qdc.jks -storepass changeit -keypass changeit

   The above created a certificate (with alias 'qdc') located at '/usr/local/qdc/qdc.jks' (the filename that was provided in the keytool command).

   Certification Details
   Use same 'keytool' command to list the certificate’s details:

   Example:
   (qdc) # keytool -list -v -keystore /usr/local/qdc/qdc.jks -storepass changeit

2. **Add Connector in server.xml** - Locate your Tomcat’s server configuration file at $TOMCAT_HOME\conf\server.xml; modify it by adding a connector element to support https connections as follows:

   Under the existing Connector, which begins "<Connector port="8080"", add the following:

   ```
   <Connector port="8443" protocol="HTTP/1.1" SSLEnabled="true"
           server="Unknown Application Server"
           maxThreads="150" scheme="https" secure="true"
           clientAuth="false" sslProtocol="TLS"
           keystoreFile="${qdc.home}/qdc.jks"
           keystoreType="JKS"
           keystorePass="changeit"
           keyPass="changeit" />
   ```

   Note: The passwords (for both 'keystorePass' and 'keyPass') must be the same passwords given when the certificate was generated.

   Make sure that redirect port is available for the connector with the default (http) port you are using. For example, default server.xml may show:

   ```
   <Connector connectionTimeout="20000" port="8080" protocol="HTTP/1.1" redirectPort="8443"/>
   ```

HTTPS Redirect Configuration: 8080 is the http port and 8443 is the https port:

1. Start the server

2. Browse http://qdc-node-hostname:8080/qdc

3. If the application doesn't redirect to https, create file $TOMCAT_HOME/webapps/qdc/WEB-INF/web.xml by either:

   (qdc) $ cp /tmp/podium/config/tomcat9-web.xml /usr/local/qdc/apache-tomcat-9.0.62/webapps/qdc/WEB-INF/web.xml

   or manually adding the following content:

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd"
   version="2.4" id="WebApp_ID">
   <session-config>
      <session-timeout>60</session-timeout>
   </session-config>
   <listener>
      <listener-class>org.springframework.web.context.request.RequestContextListener</listener-class>
   </listener>
   <security-constraint>
      <web-resource-collection>
         <web-resource-name>Entire Application</web-resource-name>
         <url-pattern>/*</url-pattern>
      </web-resource-collection>
      <user-data-constraint>
         <transport-guarantee>CONFIDENTIAL</transport-guarantee>
      </user-data-constraint>
   </security-constraint>
</web-app>
```

4. Restart Tomcat

5.6 Amazon Web Services EMR (Elastic MapReduce)

Qlik Catalog supports AWS EMR Managed Cluster Platform as a Hadoop distribution option for on-demand computing resources and services in the cloud with pay-as-you-go pricing. This functionality enables Qlik Catalog clients to spin-up a cluster on Amazon EMR using Qlik Catalog for on-demand data management, query and processing functions that are available when data sources are accessible to the cluster.

Users are able to select various types of AWS instances launched from an AMI (Amazon Machine Image) configured for environment and project needs with variable combinations of CPU, memory, storage and networking capacity. Performance options include Fixed or Burstable Performance Instances that allow users to choose and scale according to data delivery requirements.

What you can do with Qlik Catalog on AWS when the cluster is down

When the cluster is up, users are able manage their data as if running Qlik Catalog on physical on-premise servers. The following details some of the limitations that users will encounter when the AWS cluster is offline:

- **DataSource**
  - All metadata is viewable, loads will fail at the MapReduce phase, or the distribution phase if in local mode
- **Discovery**
  Everything except
  - Interactive query doesn't work
  - Profile/Sample data doesn't work if stored in Hive
- **Prepare**
  - Workflows are editable and new workflows can be added
  - Execution fails at the script execution phase for non-local, fails at the distribution phase for local
- **Publish**
  - New publish jobs and targets can be created
  - Publish fails at the data preparation (Hive) phase
- **Security/Admin**
  - Everything except policy sync

Known Limitations

1. String Hive tables on true-type Parquet /ORC are not supported because EMR has its own version of Hive that does not support true-type Parquet/ORC
2. "Decorated" types (VARCHAR, DECIMAL) are not supported on Hive tables for Parquet/ORC because EMR has its own version of Hive that does not support these types
3. Kerberos & Impersonation are not an officially supported part of EMR yet, therefore it is also not supported for Qlik Catalog EMR
4. Qlik Catalog Prepare on Spark is not supported.

EMR Node Sizing

Running a MapReduce job on EMR takes a lot of memory even for small datasets, so EMR “worker” nodes should have at least 16 GB of memory.

Network

The Qlik Catalog server can be run anywhere so long as there is network connectivity between the EMR “master” node and the Qlik Catalog server. This includes anywhere within an AWS VPC or an internal network with a VPN connection to the VPC. The Qlik Catalog node must have network access to both the EMR "master" & "worker" nodes. Modify the EMR security group OR add the Master & Slave security groups to the Qlik Catalog node during creation of the Qlik Catalog node.

EMR Cluster Setup

- EMR clusters are expensive to run 24/7, so it is best to shutdown the cluster when it is not being used.
- The best way to bring a reusable cluster up & down in a consistent & repeatable manner is to use an AWS ***Cloudformation*** script.

- A working cloudformation template is available upon request.

  Cluster Setup Considerations

  1) Assign a ***secondary IP address*** to the EMR "master" node:

     1. Because the EMR "master" node will likely obtain a different internal IP address each time a cluster is launched, the cloudformation script should assign a static **secondary IP address** to the master node.
     2. The Qlik Catalog node should be configured to point at this secondary static address so that it can always find the cluster following subsequent launches & terminations. This is accomplished by editing the various ***-site.xml*** files on the Qlik Catalog node and replacing the internal hostname with the static secondary address.

  2) ***Externalize*** Hive data which needs to persist beyond cluster terminations:

     - Use a valid S3 location for the hive warehouse data
     - Use a small RDS instance for the Hive metastore db

     Example Cloudformation Script:

```
"Configurations": [{
"Classification": "hive-site",
"ConfigurationProperties": {
"hive.mapred.mode": "nonstrict",
"hive.metastore.warehouse.dir": "s3://emr-
functional/warehouse/",
"javax.jdo.option.ConnectionURL": "jdbc:mysql:\/\/emr-
functional.cuyutghxiclj.us-east-
1.rds.amazonaws.com:3306\/hive?createDatabaseIfNotExist=true",
"javax.jdo.option.ConnectionDriverName":
"org.mariadb.jdbc.Driver",
"javax.jdo.option.ConnectionUserName": "username",
"javax.jdo.option.ConnectionPassword": "password"
```

     Manual Edits for Externalizing Hive Data (if not creating via cloudformation script):

     1). Add the following property and value into hive-site.xml:

```
<property>
   <name>hive.mapred.mode</name>
   <value>nonstrict</value>
</property>
```

     2). ADD the following property to hive-site.xml:

     hive.metastore.warehouse.dir

     Property value should be a valid S3 location: s3://<S3-bucket-name>/

     example:

```
 <property>
    <name>hive.metastore.warehouse.dir</name>
    <value>s3://emr-hive-warehouse-test-bucket1/warehouse/</value>
    <description>location of default database for the warehouse</description>
          </property>
```

5.6.1 Qlik Catalog Configuration as EMR “Edge Node”

An EC2 "edge node" which will contain the Qlik Catalog application must be created using library files from the EMR cluster "master" node. You may may create an edge node using the following process:

1) Run Edge Node Script

Use the following bash script to copy the Hadoop libraries from the EMR master node to the Qlik Catalog edge node:

1. Copy the EC2 ssh key used during EMR cluster creation to the Qlik Catalog node.
2. Edit the ***variables*** at the beginning of the script according to your AWS environment

Note: The edge node script should be run following completion of Catalog prerequisite setup but prior to running the Catalog installation script (QDCinstaller.sh).

```
--- BEGIN SCRIPT ---

#!/bin/bash

# setup logging
output_file=CreateEdgeNode_$(date +%s).log
    exec > >(tee $output_file)
    exec 2>&1

# Variables
# Set First Variables Section Specific To Your Environment
# Requires ssh key for master access to be set up prior to run

emrMasterDns="172.31.0.90"
CATALOG_SERVICE_ACCOUNT="qdc"
emrSshKey="/tmp/Dev2018.pem"
JAVA_HOME="/usr/lib/jvm/java-11-openjdk-amd64"

########################################

hadoopHome="/usr/lib/hadoop"

libDirs="/usr/lib/pig $hadoopHome /usr/share/aws/emr/emrfs /usr/lib/hadoop-lzo /usr/lib/hive /usr/lib/tez /usr/lib/sqoop
/usr/lib/hive-hcatalog /etc/tez/conf /usr/lib/spark /etc/spark/conf /usr/lib/hadoop-mapreduce /usr/share/aws/aws-java-sdk"

instanceStorePath="/mnt"

additionalDirs="$instanceStorePath/var/lib/hadoop/tmp $instanceStorePath/tmp $instanceStorePath/s3
$instanceStorePath/var/log/pig /var/log/hive/user/$CATALOG_SERVICE_ACCOUNT /var/aws/emr/"

bashRc="/home/"$CATALOG_SERVICE_ACCOUNT"/.bashrc"

# 1. Create package dirs and pull files from master node
for libDir in $libDirs; do
    echo "-------------------------"
    echo "Setting up $(echo $libDir | rev | cut -d"/" -f1 | rev )"
    sudo mkdir -p $libDir
    sudo chown -R $CATALOG_SERVICE_ACCOUNT:$CATALOG_SERVICE_ACCOUNT $libDir
    scp -r -i $emrSshKey hadoop@$emrMasterDns:$libDir/* $libDir
done

# 2. Create supporting dirs and set ownership
for addDir in $additionalDirs; do
    echo "Setting up $addDir"
    sudo mkdir -p $addDir
    sudo chown -R $CATALOG_SERVICE_ACCOUNT:$CATALOG_SERVICE_ACCOUNT $addDir
done

# 3. Add empty json object to userdata file
echo '{}' > /var/aws/emr/userData.json

# 4. Adjust the s3 buffer dir config value
sed -i 's#<value>/mnt/s3,/mnt1/s3</value>#<value>/mnt/s3</value>#g' /usr/lib/hadoop/etc/hadoop/core-site.xml

# 5. Create /mnt1 & grant service account group write access to /mnt & /mnt1
mkdir /mnt1
chown -R root:$CATALOG_SERVICE_ACCOUNT /mnt && chown -R root:$CATALOG_SERVICE_ACCOUNT /mnt1
chmod -R 775 /mnt && chmod -R 775 /mnt1

# 6. Set environment variables
newPath=$PATH
for libDir in $libDirs; do
    newPath="$newPath:$libDir/bin"
done

sed -i "/#export JAVA_HOME=/ c\export JAVA_HOME=$JAVA_HOME" /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
sed -e '/ddb/ s/^#*/#/' -i /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
sed -e '/goodies/ s/^#*/#/' -i /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
sed -e '/kinesis/ s/^#*/#/' -i /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
sed -e '/cloudwatch/ s/^#*/#/' -i /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
sed -e '/security/ s/^#*/#/' -i /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
echo "" >> /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
echo '# Added by Edge Node Script' >> /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
echo '# client needed for Sqoop' >> /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
echo 'export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop/client/*"' >> /usr/lib/hadoop/etc/hadoop/hadoop-env.sh
echo 'export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop-mapreduce/*"' >> /usr/lib/hadoop/etc/hadoop/hadoop-env.sh

echo '# Appended By Edge Node Script' >> $bashRc
echo 'export PATH="'$newPath'"' >> $bashRc
echo 'export JAVA_HOME="'$JAVA_HOME'"' >> $bashRc
echo 'export HADOOP_HOME="'$hadoopHome'"' >> $bashRc
echo 'export HADOOP_CONF_DIR="'$hadoopHome'/etc/hadoop"' >> $bashRc
echo 'export HADOOP_MAPRED_HOME="'$hadoopHome'"' >> $bashRc
echo 'export HADOOP_COMMON_HOME="'$hadoopHome'"' >> $bashRc
echo 'export HADOOP_HDFS_HOME="'$hadoopHome'"' >> $bashRc
echo 'export YARN_HOME="'$hadoopHome'"' >> $bashRc
echo 'export HADOOP_COMMON_LIB_NATIVE_DIR="'$hadoopHome'/lib/native"' >> $bashRc
echo 'export HIVE_HOME="/usr/lib/hive"' >> $bashRc
echo 'export SPARK_HOME="/usr/lib/spark"' >> $bashRc

--- END SCRIPT ---
```

2) Hadoop Classpath

The output of 'hadoop classpath' can be controlled by editing **/usr/lib/hadoop/etc/hadoop/hadoop-env.sh**.

The edge node creation script above will modify hadoop-env.sh so that is contains the following:

```
# set JAVA_HOME for the java implementation to use - Example below
# NOTE: This is an example - make sure the path defined matches location of java installation
export JAVA_HOME=/usr/lib/jvm/java-11-openjdk-amd64

# tez environment, needed to enable tez
export TEZ_CONF_DIR=/etc/tez/conf
export TEZ_JARS=/usr/lib/tez

# Add tez into HADOOP_CLASSPATH
export HADOOP_CLASSPATH=$HADOOP_CLASSPATH:${TEZ_CONF_DIR}:${TEZ_JARS}/*:${TEZ_JARS}/lib/*
export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop-lzo/lib/*"
export JAVA_LIBRARY_PATH="$JAVA_LIBRARY_PATH:/usr/lib/hadoop-lzo/lib/native"
export HADOOP_CLASSPATH=$HADOOP_CLASSPATH:/usr/share/aws/aws-java-sdk/*
export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/emrfs/conf:/usr/share/aws/emr/emrfs/lib
/*:/usr/share/aws/emr/emrfs/auxlib/*"

#export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/ddb/lib/emr-ddb-hadoop.jar"
#export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/goodies/lib/emr-hadoop-goodies.jar"
#export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/kinesis/lib/emr-kinesis-hadoop.jar"

# Add CloudWatch sink jar to classpath
#export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/cloudwatch-sink/lib/*"

# Add security artifacts to classpath
#export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/share/aws/emr/security/conf:/usr/share/aws/emr/secur
ity/lib/*"

# client needed for Sqoop
export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop/client/*"

export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop-mapreduce/*"
export HADOOP_OPTS="$HADOOP_OPTS -server -XX:OnOutOfMemoryError='kill -9 %p'"
export HADOOP_NAMENODE_OPTS=-Dsun.net.inetaddr.ttl=3600
export HADOOP_DATANODE_OPTS=-Dsun.net.inetaddr.ttl=3600
export HADOOP_NAMENODE_HEAPSIZE=1740
export HADOOP_DATANODE_HEAPSIZE=757
export HADOOP_JOB_HISTORYSERVER_HEAPSIZE=2396
# Appended by Edge Node Script
# client needed for Sqoop
export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop/client/*"
export HADOOP_CLASSPATH="$HADOOP_CLASSPATH:/usr/lib/hadoop-mapreduce/*"
```

3) .bashrc for Qlik Catalog service account

The edge node creation script above will append the following to the Catalog service account .bashrc file in /home/<service-account-name>:

```
export
PATH="/sbin:/bin:/usr/sbin:/usr/bin:/usr/lib/pig/bin:/usr/lib/hadoop/bin:/usr/share/aws/emr/emrfs/bin
:/usr/lib/hadoop-lzo/bin:/usr/lib/hive/bin:/usr/lib/tez/bin:/usr/lib/sqoop/bin:/usr/lib/hive-
hcatalog/bin:/etc/tez/conf/bin:/usr/lib/spark/bin:/etc/spark/conf/bin:/usr/lib/hadoop-
mapreduce/bin:/usr/share/aws/aws-java-sdk/bin"

export JAVA_HOME="/etc/alternatives/jre"
export HADOOP_HOME="/usr/lib/hadoop"
export HADOOP_CONF_DIR="/usr/lib/hadoop/etc/hadoop"
export HADOOP_MAPRED_HOME="/usr/lib/hadoop"
export HADOOP_COMMON_HOME="/usr/lib/hadoop"
export HADOOP_HDFS_HOME="/usr/lib/hadoop"
export YARN_HOME="/usr/lib/hadoop"
export HADOOP_COMMON_LIB_NATIVE_DIR="/usr/lib/hadoop/lib/native"
export HIVE_HOME="/usr/lib/hive"
export SPARK_HOME="/usr/lib/spark"
```

4) EMR Buffer Directories

Qlik Catalog needs the ability to create & write to /mnt/ & /mnt1 as part of the EMR buffer process. The edge node script above will create /mnt1, and it will grant the Catalog service account group write acces to /mnt & /mnt1.

5) TEZ Configuration (optional)

The following is required to get prepare-on-tez working:

1. On the edge node, build **tez.tar.gz**:

   $ cd /usr/lib/tez/

   $ tar -czvf /tmp/tez.tar.gz *.jar lib/*.jar

2. The tez.tar.gz file should be stored in a non-ephemeral location which is accessible by the Qlik Catalog node. An AWS S3 bucket is the suggested location for tez.tar.gz in EMR deployments:

   $ aws s3 cp /tmp/tez.tar.gz s3://qlik-catalog-data/

   $ aws s3 ls s3://qlik-catalog-data

3. On the edge node, set core_env property

   tez.lib.uris=s3://qlik-catalog-data/tez.tar.gz

4. Prepare-on-tez requires the ***EXPECT*** package:

   RHEL or CentOS deployments: # sudo yum install expect -y
   Ubuntu 20.04 deployments: # sudo apt install expect -y

6) Define core_env.properties values

Set the following properties within the core_env.properties file :

shippingdock.use.fulluri=true

hadoop.conf.files=core-site.xml,hdfs-site.xml,mapred-site.xml,yarn-site.xml

sample.data.method=HDFS

profile.data.method=HDFS

podium.hive.udf.jar.location=s3://<bucket-name>/qdc-hudf-<VERSION>.jar

Example: podium.hive.udf.jar.location=s3://qdc-data/qdc-hudf-<VERSION>.jar

Note: Make sure the qdc-hudf-<VERSION>.jar file exists in the bucket location. If it does not, you can copy it from $QDC_HOME/webapps/qdc/WEB-INF/lib/

7) **If Using Transient EMR Clusters: Modify Hadoop "Site-XML" Files**

Edit the following files (sudo permission required). Replace all master node hostname references with the secondary IP address assigned to the master node:

- /usr/lib/hadoop/etc/hadoop/core-site.xml
- /usr/lib/hadoop/etc/hadoop/hdfs-site.xml
- /usr/lib/hadoop/etc/hadoop/mapred-site.xml
- /usr/lib/hadoop/etc/hadoop/yarn-site.xml
- /usr/lib/hive/conf/hive-site.xml

Example:

Replace EC2 Instance *Hostname* (highlighted)

```
<property>
  <!-- URI of NN. Fully qualified. No IP.-->
  <name>fs.defaultFS</name>
  <value>ip-172-31-0-113.ec2.internal:8020 </value>
 </property>
```

With *Secondary IP Address* Assigned To Master Node

```
<property>
  <!-- URI of NN. Fully qualified. No IP.-->
  <name>fs.defaultFS</name>
  <value>172.31.0.90:8020 </value>
 </property>
```

5.7 Ranger

Qlik Catalog only uses Hadoop standard API's for accessing Hadoop. As a result, Qlik Catalog will naturally take advantage of in-place ranger policies by reporting a "permission denied" result to the end user if HDFS or Hive access is restricted. However, security configuration scenarios vary from company to company.

There is one scenario where it's mandatory that a special admin user perform all work in Hive while impersonation is enabled in Qlik Catalog. If so, Qlik Catalog can directly interface with Ranger and dynamically create Hive/HDFS policies that apply to the USER who executed the work in Qlik Catalog and not just the Hive admin user. This allows the user to access this data outside of Qlik Catalog.

Ranger/Qlik Catalog Integration: Prerequisites and core_env.properties

- Impersonation must be enabled. See here for details on enabling impersonation in Ranger.
- Ranger and Qlik Catalog have the same Users and Groups and associations through integration with Active Directory (Refer to Apache documentation for instructions on pulling in users from UNIX, LDAP, or AD to populate Ranger's local user tables via UserSync.)
- User specified in this core_env property must have permission to make updates in Ranger (example: hive.admin.user=newuser)
- A SuperUser Group (of Qlik Catalog SuperUsers) with ALL permissions must be created in Ranger; refer to instructions below to manually create this group
- Ensure that Group names in Ranger are in lowercase.
- The following **core_env properties** must be configured:

Qlik Catalog (core_env) Properties for Apache Ranger
Authorization Properties
This property specifies the policy management tool for the cluster. # Possible values (case-insensitive): RANGER, NONE **example:** authorization.mode = RANGER
#This property specifies what components on the cluster are authorized with the policy management tool enabled with authorization.mode property. #Possible values (case-insensitive): HIVE, HDFS, ALL #Default value: ALL **example:** authorization.component = ALL #This property decides whether distribution (tables) are to be created or not while syncing policies (before data is loaded). If value is true (default), distribution tables will be created when the policy is created/synced. If the value is false, distribution tables are created when data is loaded. create.distribution.on.sync = true
Apache Ranger Properties (core_env)
#Specifies Ranger Admin portal URL **example:** ranger.admin.portal.url = http:// <rangerhostportal.url.com>:6080
#Specifies Ranger Admin portal username **example:** ranger.admin.portal.username = admin
#Specifies Admin portal password **example:** ranger.admin.portal.password = #0{5QaBqDr7Ks+16WCqam5Z6Q==}
#Specifies the Ranger service name for hive **example:**

ranger.service.hive = podium_ducks_hive
#Specifies the Ranger service name for hdfs **example:** ranger.service.hdfs = podium_ducks_hadoop

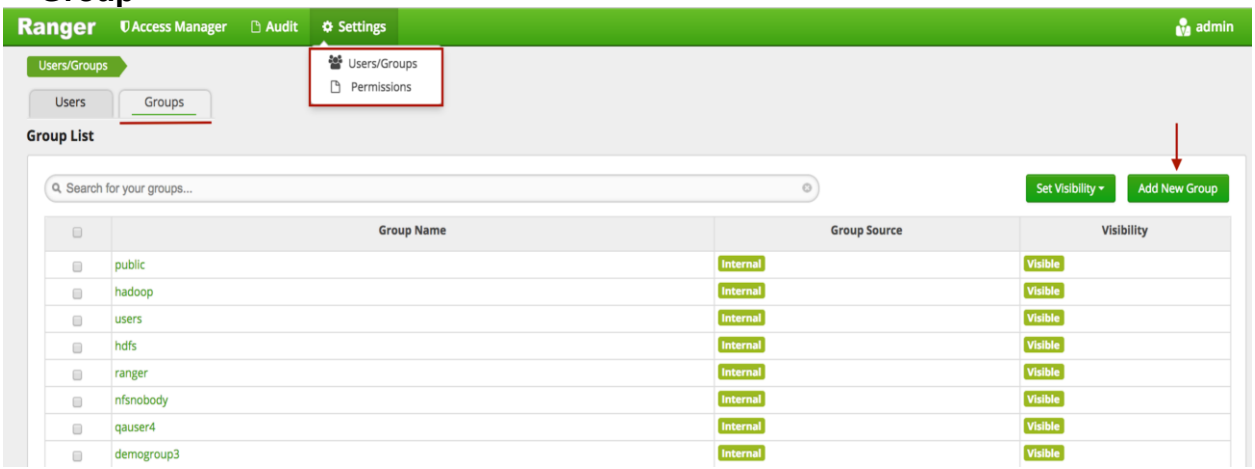
#Use full URI for shipping paths
shippingdock.use.fulluri=true

Apache Ranger Setting in Ambari to address case sensitivity
Ranger authorization is case sensitive therefore if the username/group id doesn't match the id returned from the Directory (AD/LDAP) authorization will be denied. Particularly where AD/LDAP environments are using Ranger, case must match between AD/LDAP, Qlik Catalog, and Ranger. Set the following properties in Ranger with Ambari to ensure matching case across the applications to “upper” or “lower” [default is “none”]. Note that Ranger service on Ambari must be restarted for the changes to take effect: ranger.usersync.ldap.username.caseconversion ranger.usersync.ldap.groupname.caseconversion

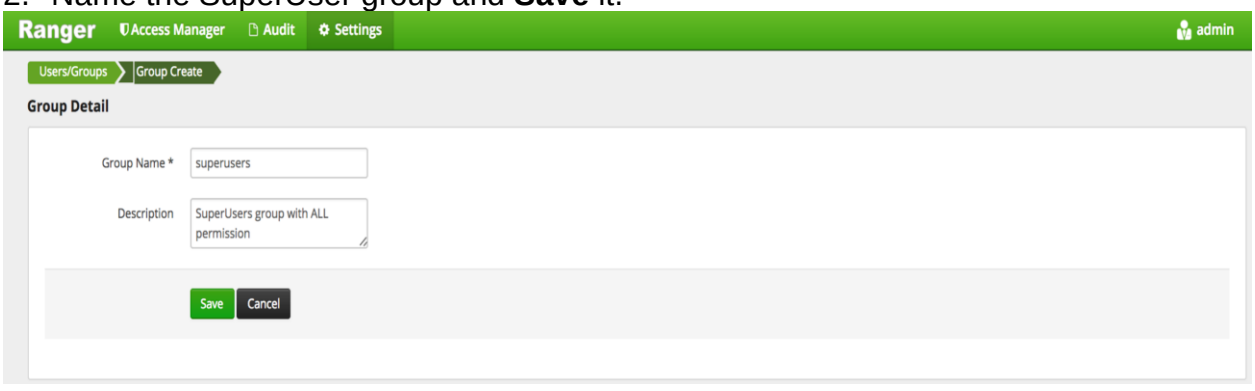
Setting Up SuperUser Group in Ranger for Qlik Catalog SuperUsers

The following instructions set up a Ranger group of Qlik Catalog SuperUsers into a SuperUser group with ALL Privileges.

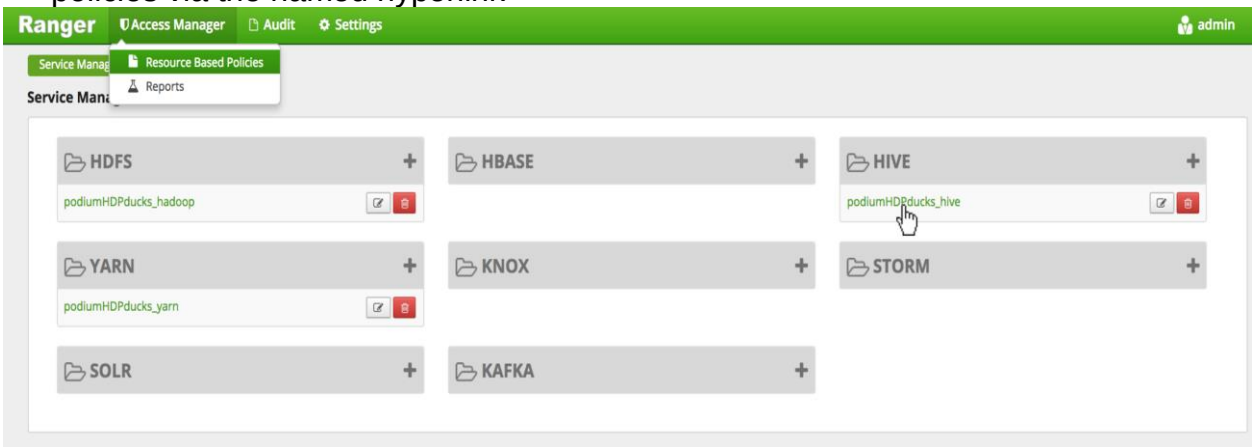
1. From **Settings**, select **Users/Groups**, then select **Groups** tab and **Add New Group**



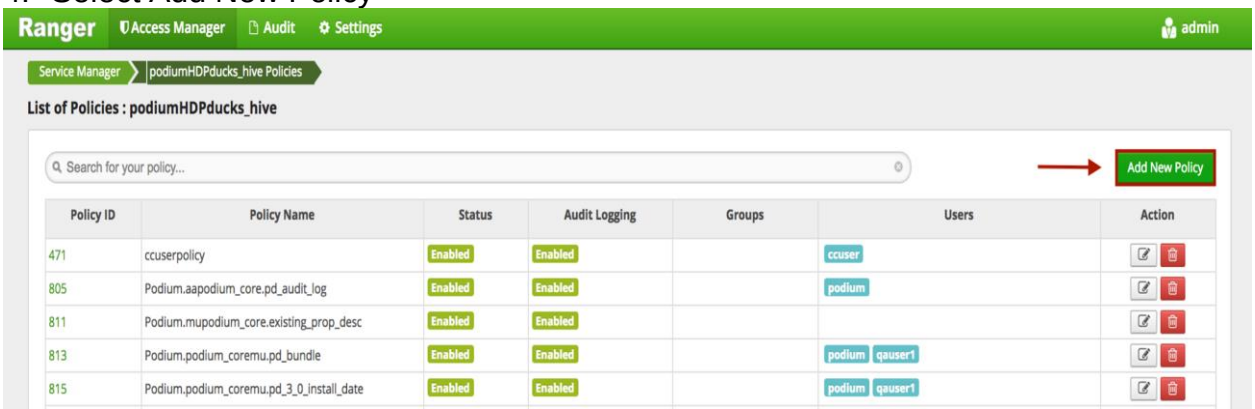
2. Name the SuperUser group and **Save** it.



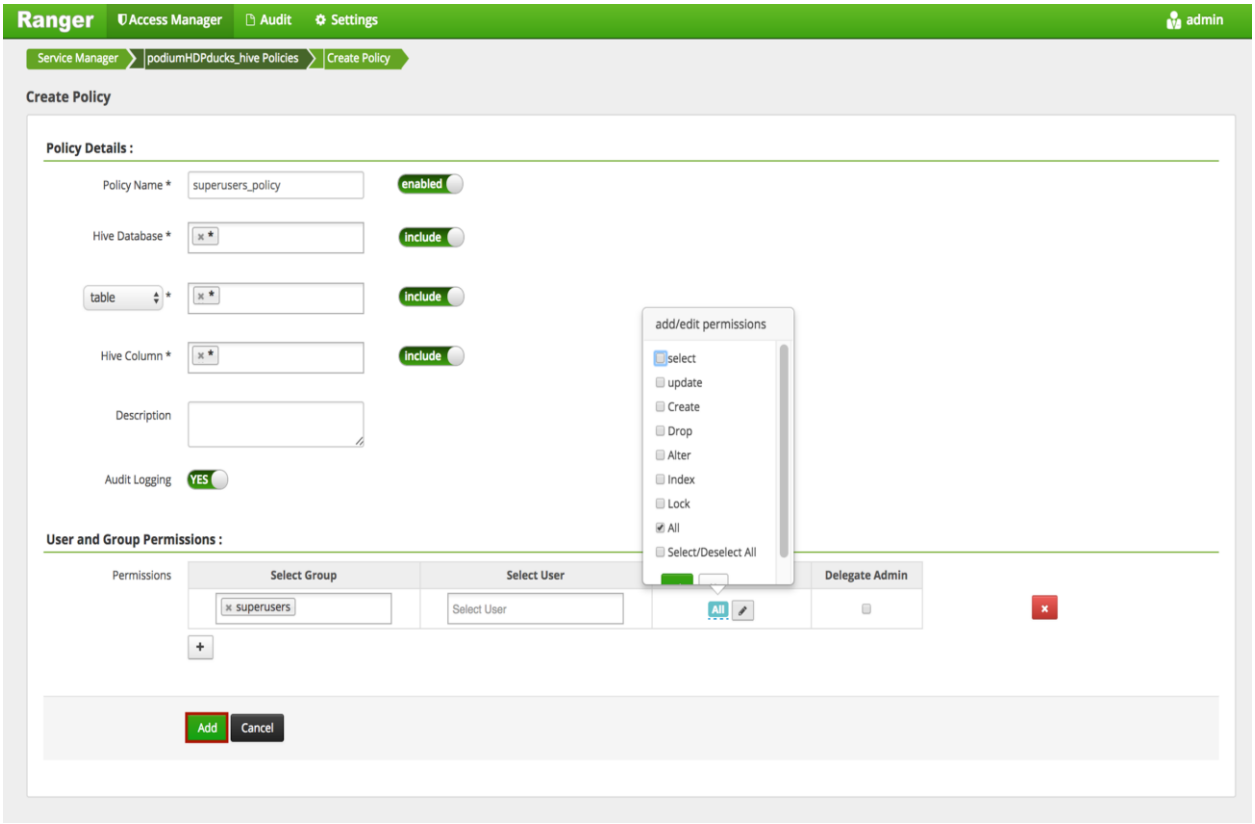
3. From **Access Manager**, select **Resource Based Policies** and open HIVE policies via the named hyperlink



4. Select Add New Policy



5. In **Create Policy** screen, name the Policy name with a name that will identify the SuperUser group.
   Specify asterisk (*) for **Hive Database**, **table**, **Hive Column**.
   Select the newly created SuperUser group from the **Select Group** dropdown in User and Group Permissions. Skip over **User Select.**
   [Note that Qlik Catalog only applies permission at group level and does not employ column-level permissions at this time.]
   Select the plus '**+**' to the right of **Add Permissions** in the Permissions column, specifying **All**, save the selected permissions, select **Add** in the lower left of the screen.
   The new group (superusers) has an associated policy with **All** permissions for all Hive Tables.

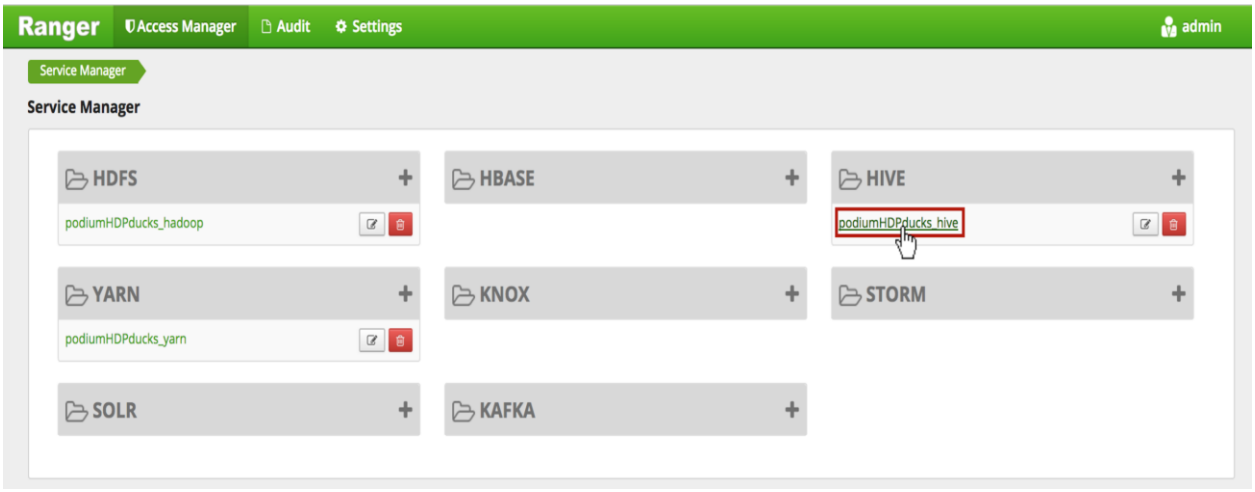


Setting Up SuperUser Group in Ranger for Qlik Catalog SuperUsers
The following instructions set up a Ranger group of Qlik Catalog SuperUsers into a SuperUser group with ALL Privileges.

From **Settings**, select **Users/Groups**, then select **Groups** tab and **Add New Group**

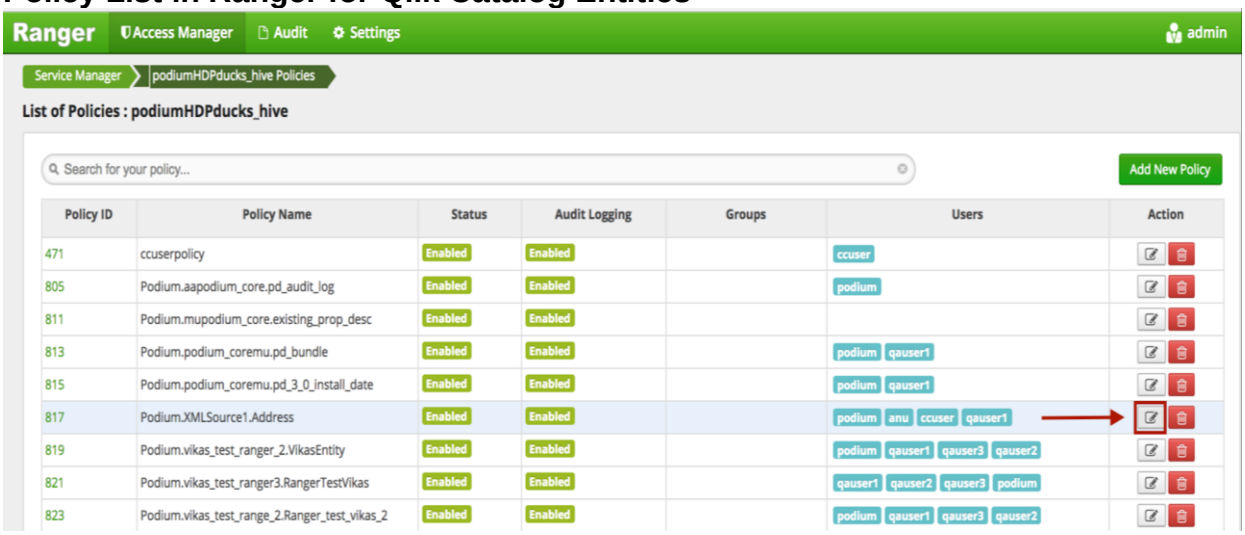
Ranger Admin Console
The **Service Manager** screen in Ranger is where users view the services they have enabled to sync with security policies on Qlik Catalog objects.
Hadoop Administrators can add services by selecting the plus icon next to the Hadoop component, enter Service Name/Description, enable/disable policies, and configure service properties and authentication specifications particular to those services.
For Qlik Catalog, Hadoop administrators should enable Hive and HDFS services for their cluster. For every entity, Qlik Catalog creates two policies, one for HDFS and one for Hive.

Ranger Admin Console: Service Manager
Select either HDFS or HIVE Service Name quicklink to access individual policies.



Ranger Hive Policies
Select the edit icon to the right of individual entities to access and update individual Hive entity policies.

Policy List in Ranger for Qlik Catalog Entities

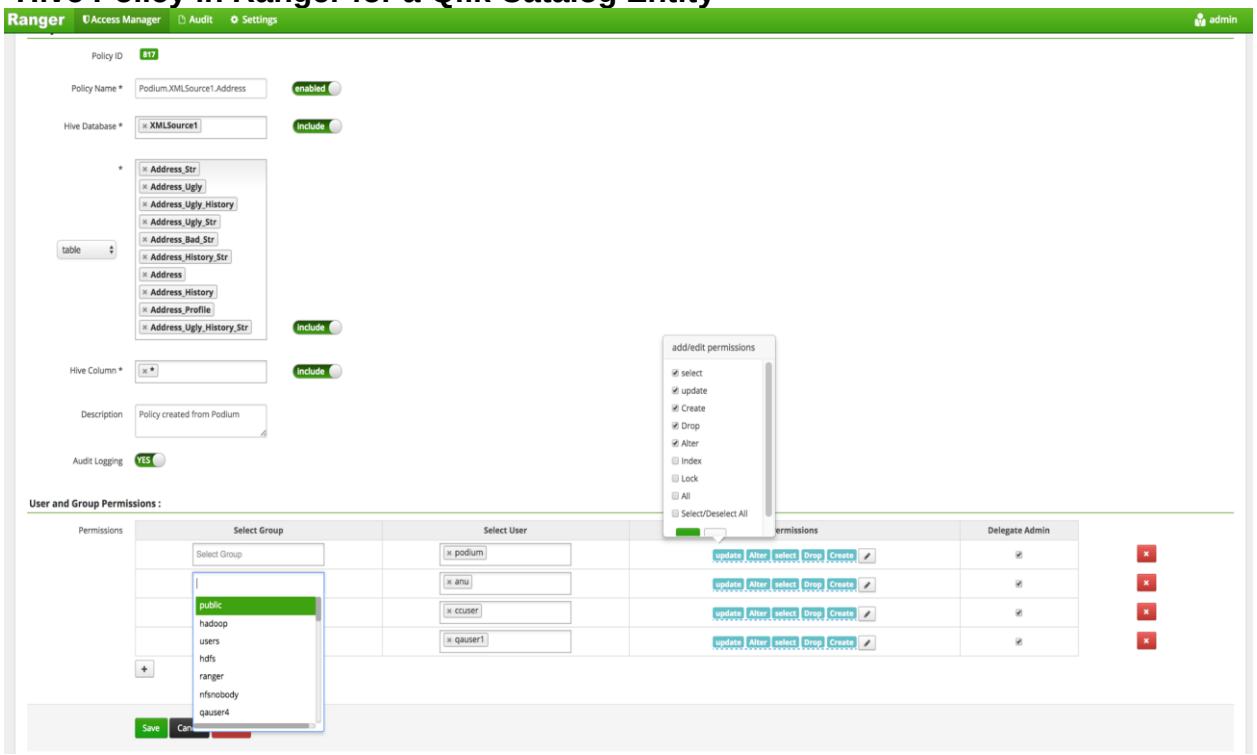


Editing policies: Synchronization between Qlik Catalog Group level access and Ranger policies will be automatic. Note that while all users in Qlik Catalog have different roles and varying permission levels in the Qlik Catalog application, permissions ('ALL') are granted at the Group level in Ranger. Hive policies in Ranger for Qlik Catalog entities remain in sync with Qlik Catalog Hive tables via Qlik Catalog Sentinel Sync Admin Wizard.
****Add hdfs and hive users to all wildcard policies (ex. "/home*")**

Hive Policies in Ranger: Settings	
Policy ID: Each policy receives an ID (HDFS policy ID is the Hive policy number + 1)	
Policy Name: Policy naming convention is [Podium.<sourcename>.<entityname>]	
Hive Database: Source Name	
Hive Tables:	entityname entityname_str entityname_history entityname_history_str entityname_history_bad_str entityname_bad_str entityname_ugly entityname_ugly_str

	entityname_history_ugly entityname_history_ugly_str entityname_profile
Hive Column: While Ranger supports column level access, Qlik Catalog does not currently support column level security integration.	
Description: User-defined information about the policy.	
Audit Logging: Enables Audit logging in Ranger.	
User and Group Permissions: All users will have 'ALL' permissions (update, Alter, select, Drop, Create)	

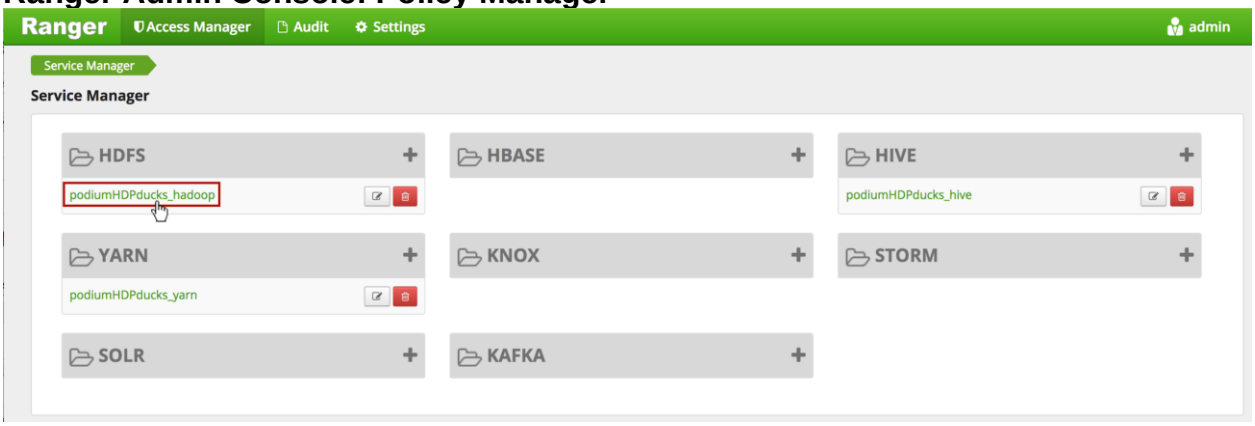
Hive Policy in Ranger for a Qlik Catalog Entity



Ranger HDFS Policies

Select the edit icon to the right of the Service Name to access individual HDFS entity policies in Ranger.

Ranger Admin Console: Policy Manager

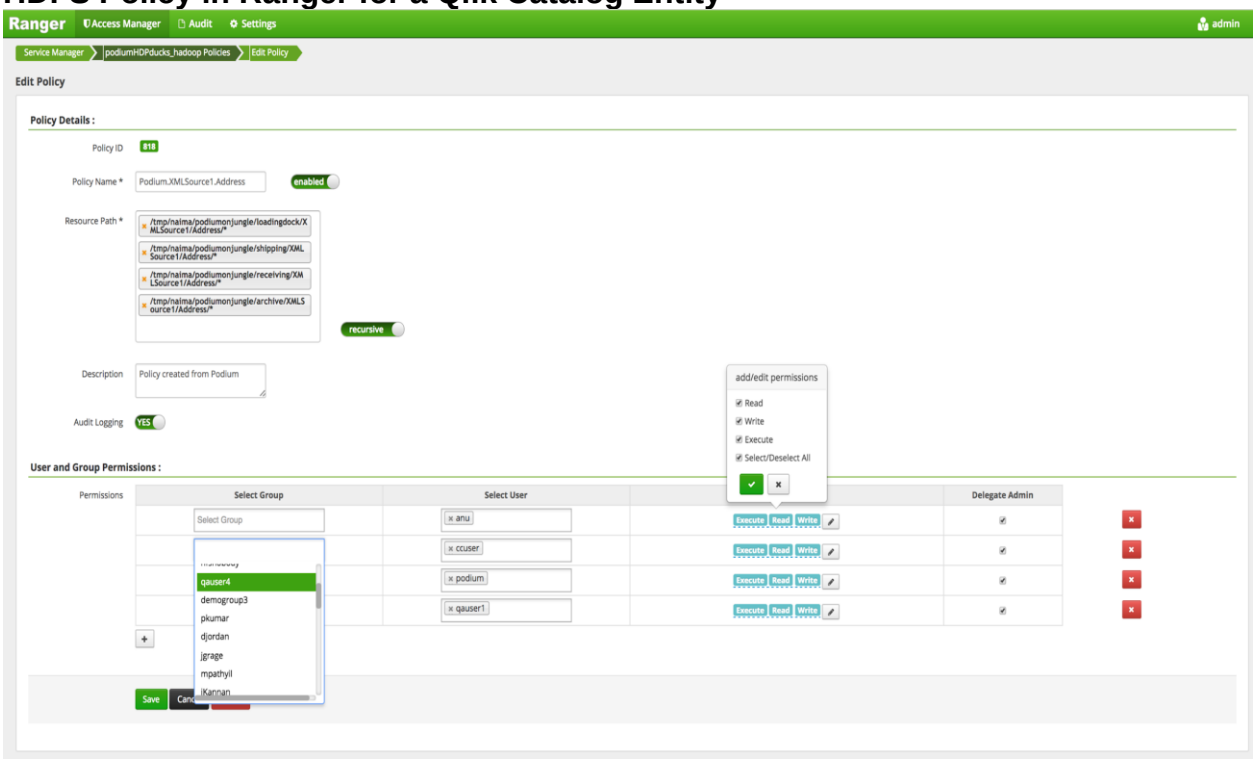


Editing policies: Synchronization between Qlik Catalog Group level access and Ranger policies will be automatic though Hadoop administrators can go into individual policies to

review and disable/enable the policies. Note that Ranger serves as the backend metastore to manage and sync policies at group level.

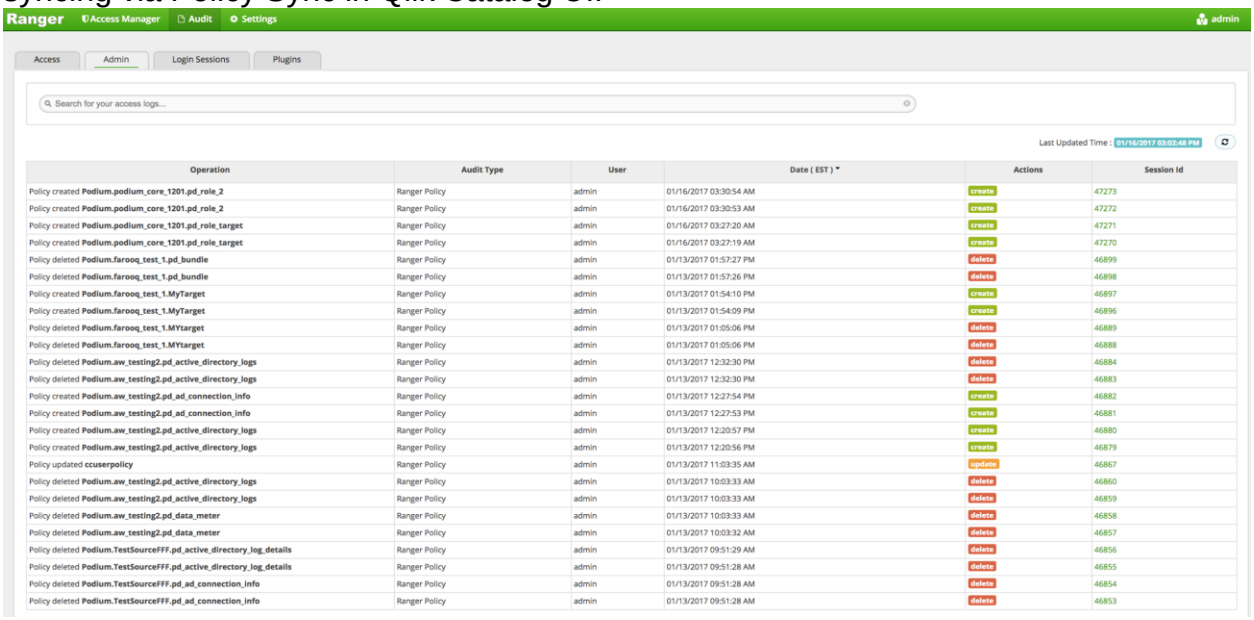
HDFS Policies in Ranger: Settings	
Policy ID: Each policy receives an ID (HDFS policy ID is the Hive policy number + 1)	
Policy Name: Policy naming convention is [Catalog.<sourcename>.<entityname>] Note that when a user makes a change to the source/entity this change is reflected/persisted in the corresponding Ranger policy.	
Resource Path: URI for HDFS directories: loading dock|shipping|receiving|archive.<sourcename>.<entityname>/*	
Resource Path	URIs for Qlik Catalog HDFS Directories (loading dock, receiving, archive, shipping) **examples:** /tmp/user/<servicehost>/loadingdock/<sourcename>/<entityname>/* /tmp/user/<servicehost>/shipping/<sourcename>/<entityname>/* /tmp/user/<servicehost>/receiving/<sourcename>/<entityname>/* /tmp/user/<servicehost>/archive/<sourcename>/<entityname>/* Note: Select 'recursive' to apply policies across all directories and its contents including the contents of any subdirectories.
Description: User-defined information about the policy.	
Audit Logging: Enable Audit logging in Ranger	
User and Group Permissions: Synchronization of Directory permissions and ACLS (These will always be ALL: Read, Write, Execute)	

HDFS Policy in Ranger for a Qlik Catalog Entity



Audit Screen

Changes to entities and corresponding policies can tracked through an Audit screen in the Ranger Admin console. It is recommended to manage and monitor Qlik Catalog object syncing via Policy Sync in Qlik Catalog UI.



Operation	Audit Type	User	Date (EST)	Actions	Session Id
Policy created **Podium.podium_core_1201.pd_role_2**	Ranger Policy	admin	01/16/2017 03:30:54 AM	create	47273
Policy created **Podium.podium_core_1201.pd_role_2**	Ranger Policy	admin	01/16/2017 03:30:53 AM	create	47272
Policy created **Podium.podium_core_1201.pd_role_target**	Ranger Policy	admin	01/16/2017 03:27:20 AM	create	47271
Policy created **Podium.podium_core_1201.pd_role_target**	Ranger Policy	admin	01/16/2017 03:27:19 AM	create	47270
Policy deleted **Podium.farooq_test_1.pd_bundle**	Ranger Policy	admin	01/13/2017 01:57:27 PM	delete	46899
Policy deleted **Podium.farooq_test_1.pd_bundle**	Ranger Policy	admin	01/13/2017 01:57:26 PM	delete	46898
Policy created **Podium.farooq_test_1.MyTarget**	Ranger Policy	admin	01/13/2017 01:54:10 PM	create	46897
Policy created **Podium.farooq_test_1.MyTarget**	Ranger Policy	admin	01/13/2017 01:54:09 PM	create	46896
Policy deleted **Podium.farooq_test_1.MYtarget**	Ranger Policy	admin	01/13/2017 01:05:06 PM	delete	46889
Policy deleted **Podium.farooq_test_1.MYtarget**	Ranger Policy	admin	01/13/2017 01:05:06 PM	delete	46888
Policy deleted **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 12:32:30 PM	delete	46884
Policy deleted **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 12:32:30 PM	delete	46883
Policy created **Podium.aw_testing2.pd_ad_connection_info**	Ranger Policy	admin	01/13/2017 12:27:54 PM	create	46882
Policy created **Podium.aw_testing2.pd_ad_connection_info**	Ranger Policy	admin	01/13/2017 12:27:53 PM	create	46881
Policy created **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 12:20:57 PM	create	46880
Policy created **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 12:20:56 PM	create	46879
Policy updated **ccuserpolicy**	Ranger Policy	admin	01/13/2017 11:03:35 AM	update	46867
Policy deleted **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 10:03:33 AM	delete	46860
Policy deleted **Podium.aw_testing2.pd_active_directory_logs**	Ranger Policy	admin	01/13/2017 10:03:33 AM	delete	46859
Policy deleted **Podium.aw_testing2.pd_data_meter**	Ranger Policy	admin	01/13/2017 10:03:33 AM	delete	46858
Policy deleted **Podium.aw_testing2.pd_data_meter**	Ranger Policy	admin	01/13/2017 10:03:32 AM	delete	46857
Policy deleted **Podium.TestSourceFFF.pd_active_directory_log_details**	Ranger Policy	admin	01/13/2017 09:51:29 AM	delete	46856
Policy deleted **Podium.TestSourceFFF.pd_active_directory_log_details**	Ranger Policy	admin	01/13/2017 09:51:28 AM	delete	46855
Policy deleted **Podium.TestSourceFFF.pd_ad_connection_info**	Ranger Policy	admin	01/13/2017 09:51:28 AM	delete	46854
Policy deleted **Podium.TestSourceFFF.pd_ad_connection_info**	Ranger Policy	admin	01/13/2017 09:51:28 AM	delete	46853

5.8 Adding Qlik Core Docker Container to Existing Cluster Installation

The installer performs the following for a first-time install of June 2019 (4.2) or later. This section describes how to manually add Qlik Core support to a Qlik Catalog cluster-capable installation. It is documented for reference purposes.

First, ensure section 3.5, Container Platform & Node.js Installation, has been completed.

The commands below assume the Qlik Catalog home directory is /usr/local/qdc and that the service account user is qdc. Do the following:

1. Make a Qlik Core integration directory (perform as service user: sudo su - qdc):

   ```
   (qdc) $ cd /usr/local/qdc
   (qdc) $ mkdir qlikcore
   (qdc) $ cd qlikcore
   ```

2. Copy the Qlik Sense integration files, included in the Qlik Catalog (podium.zip), to '/usr/local/qdc/qlikcore' directory. Replace the path '/tmp/podium/bin/qlikSenseIntegration/' with the path to your unzipped podium.zip.

   ```
   (qdc) $ cp /tmp/podium/bin/qlikSenseIntegration/* .
   ```

3. Load the Qlik Engine docker image:

   RHEL 7/CentOS 7 Deployments using *Docker*

   ```
   (qdc) $ docker load < engine.tar
   ```

   RHEL 8/Ubuntu 20.04 Deployments using *Podman*

   ```
   (qdc) $ podman load < engine.tar
   ```

4. To test, list images:

   RHEL 7/CentOS 7 Deployments using *Docker*

   ```
   (qdc) $ docker images
   ```

   RHEL 8/Ubuntu 20.04 Deployments using *Podman*

   ```
   (qdc) $ podman images
   ```

5. Register node modules:

   ```
   (qdc) $ npm install --only=prod
   ```

6. To test, list modules:

   ```
   (qdc) $ npm ls
   ```

7. Start the Qlik Engine container

(qdc) $ ./launch_qlikContainers.sh

8. Set the following property in Qlik Catalog's <tomcat home>/conf/core_env.properties

   qvd.openconnector.script.path=/usr/local/qdc/qlikcore/qdc_qvd_2_csv.sh %prop.qvd.file.linux.folder %prop.qvd.file.entity.original.name %loadingDockLocation %loadingDockUri

Please refer to other documentation for guidance on configuring Qlik Catalog and Qlik Sense integration, including using the Qlik Core Docker container to load a QVD.

5.9 Integration Setup Between Qlik Sense and Qlik Catalog

The configuration process for Integrating *Qlik Catalog* with *Qlik Sense* is detailed in a document called QlikDataCatalystQlikSense_<Month.year>_IntegrationGuide.pdf

5.10 Enabling NextGen XML

As of the May 2022 release, NextGen XML (along with Tomcat HTTPS) is automatically enabled for first-time installs that use QDCprereqs.sh.

NextGen XML Containers

- To use the 'next-generation' XML support in Qlik Catalog, the Catalog installer (QDCinstaller.sh) installs two Qlik Sense containers: DCaaS (a connector lookup service) and a REST Connector (that parses XML files and converts them to flattened data).
- The NextGen XML Docker containers must be setup as a service to automatically start when Linux restarts.

The copy (cp) command below assumes the Qlik Catalog software (a.k.a., podium zip) has been expanded to /tmp -- the prerequisites section.

IMPORTANT:

a) If the Qlik Catalog NextGen XML directory is not /usr/local/qdc/dcaasIntegration or the service user/group is not "qdc," the file **/etc/systemd/system/nextgen-xml.service** must be edited after the copy (cp) step below

b) If deploying to RHEL 8 or Ubuntu 20.04 which use Podman to manage containers you must edit **/etc/systemd/system/nextgen-xml.service** after the copy (cp) step below:

   a. **REMOVE** line 13 completely:

      Requires=docker.service

   b. EDIT line 14 and remove the following text: **docker.service**

(sudo) # sudo cp /tmp/podium/config/nextgen-xml.service /etc/systemd/system/
(sudo) # sudo systemctl daemon-reload
(sudo) # sudo systemctl enable nextgen-xml.service

Qlik Catalog Configuration

Qlik Catalog must be configured to support NextGen XML.

- **core_env.properties**

  The core_env.properties file is located here: $TOMCAT_HOME/conf/core_env.properties.

  Locate the following property and replace $CATALOG_IPADDRESS with the IP address of the Qlik Catalog server:

  - base.xml.callback.url= http://$CATALOG_IPADDRESS:8082/qdc-xmlstore

  Note: the following two NextGen XML properties are also present in the core_env.properties file and are set automatically by the Qlik Catalog Installer:

  - enable.new.xml.ingestion=true
  - dcaas.connector.staging.dir=<QDC_HOME>/dcaasIntegration/dcaas-connector-staging

Modify Tomcat Web Server Configuration

NOTE: As of the May 2022 release, if the optional prerequisites script QDCprereqs.sh is used, the NextGen XML feature and Tomcat are ***automically configured to work together*** and this section can be ignored.

Manual configuration changes to the Tomcat web server are also required. Follow the instructions below to modify the Tomcat server.xml file to support NextGen XML:

1) Using a text editor, open **$TOMCAT_HOME/conf/server.xml:**

```
(qdc)  $ vi /usr/local/qdc/apache-tomcat-9.0.62/conf/server.xml
```

2) Add a dedicated Service and Connector

A dedicated service and connector are setup to listen on port 8082. The connector is configured to only allow localhost / local subnet connections (e.g., 127.0.0.1, 192.168.*.*, 172.16.*.*), thereby prohibiting outside access.

This new Service should come after the existing Service and is likely near the end of the document, near the closing </Server> tag. Here is the XML:

```
  <!-- The qdc-xmlstore directory is a temporary location for serving XML files to the DCaaS REST connector.
By default, it is configured
    to allow localhost and private IP access only. To allow access from an external host, add the host's IP
address with a pipe '|' separator
    to the end of the 'allow' value. For instance,
    allow="127\.\d+\.\d+\.\d+|::1|0:0:0:0:0:0:0:1|...|11.111.3.241" -->

  <Service name="qdc-xmlstore">
    <Connector port="8082" protocol="org.apache.coyote.http11.Http11NioProtocol"
      connectionTimeout="20000" />
    <Engine name="Catalina" defaultHost="localhost">
      <Host name="localhost" appBase="qdc-xmlstore" unpackWARs="true" autoDeploy="true">
        <Context docBase="${qdc.home}/dcaasIntegration/qdc-xmlstore" path="/qdc-xmlstore">
          <Valve className="org.apache.catalina.valves.RemoteAddrValve"
```

```
                allow="127\.\d+\.\d+\.\d+|::1|0:0:0:0:0:0:0:1|10\.\d+\.\d+\.\d+|172\.1[6-9]\.\d+\.\d+|172\.2[0-
9]\.\d+\.\d+|172\.3[0-1]\.\d+\.\d+|192\.168\.\d+\.\d+" />
            </Context>
          </Host>
        </Engine>
    </Service>
```

Port 8082 can be changed -- if changed, make sure to update core_env property base.xml.callback.url. The above Context is standard for NextGen XML and prohibits outside access.

4) Save the changes to server.xml and **restart Tomcat**

5) Restart NextGen XML docker containers:

```
(sudo)  # sudo systemctl restart nextgen-xml.service
```

6) **To verify that Docker and its containers are running:**

- Enter this on a command line: docker ps (or podman ps)
- Expected result: you should see the dcaas and data-connector-rest containers in the list of active containers.

Note: If SELinux is enabled (or other security framework), you may need to open port 50060 to allow routing between the two containers:

```
(sudo)  # sudo firewall-cmd --zone=public --permanent --add-port=50060/tcp
```

```
(sudo)  # sudo systemctl restart firewalld.service
```

5.11 Migrating to or Upgrading Tomcat 9

Beginning with the May 2021 release, only Apache Tomcat 9 is supported. The installer will prohibit other versions. If using Tomcat 7, please first initiate a migration to Tomcat 9 before installing this release. Then, when installing, the upgrade option (-u) is ***NOT*** used.

These instructions may also be used to upgrade from an older version of Tomcat 9 to a newer version.

Step	Sample Commands
Shutdown and rename old Tomcat 7 or 9	cd /usr/local/qdc (or cd /usr/local/podium) ./apache-tomcat-<OLD_VERSION>/bin/shutdown.sh mv apache-tomcat-<OLD_VERSION> old-apache-tomcat

Step	Sample Commands
Download and expand Tomcat 9 - **NOTE: adjust version 9.0.62 to use latest 9.0.x series**	wget https://archive.apache.org/dist/tomcat/tomcat-9/v9.0.62/bin/apache-tomcat-9.0.62.tar.gz tar -xf apache-tomcat-9.0.62.tar.gz rm apache-tomcat-9.0.62.tar.gz
Copy core_env.properties from old Tomcat 7 to new Tomcat 9	cp old-apache-tomcat/conf/core_env.properties apache-tomcat-9.0.62/conf/
If migrating from Tomcat 7: Extract server.xml from podium.zip and copy to new Tomcat	unzip -j podium-4.14-xxxxx.zip podium/config/tomcat9-server.xml -d . mv ./tomcat9-server.xml apache-tomcat-9.0.62/conf/server.xml
If upgrading Tomcat 9: Copy server.xml from old Tomcat 9 to new Tomcat 9	cp old-apache-tomcat/conf/server.xml apache-tomcat-9.0.62/conf/ If the old Tomcat 9 was configured for HTTPS, and the keystore (jks file) was stored in the old Tomcat directory, migrate it to the new Tomcat directory, and update conf/server.xml to reference it. Consider placing the keystore file in a non-Tomcat directory such as /usr/local/qdc/keystore.
Configure QDCinstaller.properties for Tomcat 9	Whether using an existing QDCinstaller.properties file from a previous install, or configuring one for the first time, ensure that it is updated to point to Tomcat 9: TOMCAT_HOME=/usr/local/podium/apache-tomcat-9.0.62

Step	Sample Commands
Finally, when the installer is run, **do *NOT* specify upgrade mode (-u)**, as some files should be created as if it were a first-time install.	./QDCinstaller.sh
After installation, restore webapp web.xml, then restart Tomcat	cp old-apache-tomcat/webapps/qdc/WEB-INF/web.xml apache-tomcat-9.0.62/webapps/qdc/WEB-INF/

At this point, Tomcat 9, if newly installed, will support only HTTP on port 8080.

Verify successful Qlik Catalog startup and basic functionality.

Additional configuration will be required to configure HTTPS on port 8443, apply security headers, etc. If Tomcat 7 used HTTPS, the keystore (jks file) containing the public-private keypair should be copied to Tomcat 9 and conf/server.xml updated.For more information, see **Error! Reference source not found.**

In addition, Tomcat 7 may have been configured as a service. It should be disabled. Tomcat 9 may be configured as a service to automatically start. For more information, see setting up Tomcat as a service.

5.12 Disabling Tomcat Redirect / SSL

As of the May 2022 release, when using the optional prerequisites script QDCprereqs.sh, Tomcat is automatically configured for HTTPS (including the generation of a self-signed certificate), and requests on port 8080 are automatically redirected to 8443.

In certain situations, these may need to be disabled (e.g., when the SSL connection is terminated at a load balancer). Perform either or both of the following and then restart Tomcat.

Disable Redirect from 8080 to 8443

Edit <tomcat home>/webapps/qdc/WEB-INF/web.xml

Remove the entire "<security-constraint>" element.

Disable HTTPS Port 8443

First, disable the redirect (see above).

Edit <tomcat home>/conf/server.xml

Remove the entire "<Connector>" element which begins "<Connector port="8443"

5.13 Upgrading PostgreSQL

These instructions may be used to upgrade to the latest version of Qlik Catalog custom PostgreSQL. Reminder: there is no requirement to upgrade PostgreSQL when upgrading Catalog. If a PostgreSQL upgrade is planned, please do so before upgrading Catalog.

Step	Sample Commands
Shutdown Tomcat	./bin/shutdown.sh
Backup databases. Default password for podium_md is "nvs2014!" For licenses is "licenses". For postgres is "postgres".	pg_dump -U podium_md --format=c --file=podium_md.sqlc podium_md pg_dump -U licenses --format=c --file=licenses.sqlc licenses
Find the Linux PostgreSQL service file name. Will be something like "qdc_pg.service" or "qdc_pg-11.2.service" -- **USE THIS NAME FOR NEXT TWO STEPS**	ls -la /etc/systemd/system/
Stop the service and verify PostgreSQL is not running	sudo systemctl stop qdc_pg-11.2.service ps -ef | grep "postgres:"
Remove the service	sudo systemctl disable qdc_pg-11.2.service sudo rm /etc/systemd/system/qdc_pg-11.2.service

Step	Sample Commands
Prepare for new PostgreSQL -- **adjust version as needed**	sudo mkdir -p /usr/pgsql/qdc11-15 sudo chown -R postgres:postgres /usr/pgsql sudo mkdir -p /var/lib/pgsql/11-15/qdc_data sudo chown -R postgres:postgres /var/lib/pgsql
Install new PostgreSQL -- **adjust versions as needed**	cp podium-4.14-xxxxx_Linux_X64.zip /tmp/ cd /tmp unzip podium-4.14-xxxxx_Linux_X64.zip sudo su - postgres /tmp/podium/thirdParty/qdc_pg11-15_RHEL7-and-CentOS7.bsx **OR** /tmp/podium/thirdParty/qdc_pg11-15_RHEL8-and-CentOS8.bsx **OR** /tmp/podium/thirdParty/qdc_pg11-15_Ubuntu.bsx exit
Recreate symlinks	sudo rm /usr/bin/psql sudo ln -s /usr/pgsql/qdc11-15/bin/psql /usr/bin/psql psql --version sudo rm /usr/bin/pg_dump sudo ln -s /usr/pgsql/qdc11-15/bin/pg_dump /usr/bin/pg_dump pg_dump --version sudo rm /usr/bin/pg_restore sudo ln -s /usr/pgsql/qdc11-15/bin/pg_restore /usr/bin/pg_restore pg_restore --version

Step	Sample Commands
Recreate Linux service	sudo cp /tmp/podium/config/qdc_pg.service /etc/systemd/system/ sudo systemctl daemon-reload sudo systemctl enable qdc_pg.service
Ensure Tomcat service depends on new PostgreSQL service -- all references should be to "qdc_pg.service"	sudo vi /etc/systemd/system/tomcat.service
Start the service and verify PostgreSQL is running	sudo systemctl start qdc_pg.service ps -ef | grep "postgres:"
Restore podium_md. Default password for podium_md is "nvs2014!" For licenses is "licenses". For postgres is "postgres".	INTERNAL_DB_PASSWORD=nvs2014! psql template1 -U postgres -c "create role podium_md with encrypted password '$INTERNAL_DB_PASSWORD' createdb login;" psql template1 -U podium_md -c "create database podium_md;" pg_restore -U podium_md --dbname=podium_md podium_md.sqlc
Restore licenses	psql template1 -U postgres -c "create user licenses with password 'licenses'" psql template1 -U postgres -c "create database licenses owner licenses" pg_restore -U licenses --dbname=licenses licenses.sqlc
Proceed to upgrade Catalog	

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