Installation Guide

/ ForgeRock Identity Management 6.0

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Abstract

Guide to installing, updating, and uninstalling ForgeRock® Identity Management software. This software offers flexible services for automating management of the identity life cycle.

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Preface

ForgeRock Identity Platform™ serves as the basis for our simple and comprehensive Identity and Access Management solution. We help our customers deepen their relationships with their customers, and improve the productivity and connectivity of their employees and partners. For more information about ForgeRock and about the platform, see https://www.forgerock.com.

1. About This Guide

This guide shows you how to install ForgeRock Identity Management services for identity management, provisioning, and compliance. Unless you are planning an evaluation or test installation, read the Release Notes before you get started.

This guide is written for anyone installing ForgeRock Identity Management (IDM) software to manage identities, and to ensure compliance with identity management regulations.

It covers the install and removal (uninstall) procedures that you theoretically perform only once per version. It aims to provide you with at least some idea of what happens behind the scenes when you perform the steps.

You do not need a complete understanding of IDM software to learn something from this guide, though a background in identity management and maintaining web application software can help. You do need some background in managing services on your operating systems and in your application servers. You can nevertheless get started with this guide, and then learn more as you go along.

If you have a previous version of IDM software installed, see "*Compatibility*" in the *Release Notes* before you install this version.

2. Accessing Documentation Online

ForgeRock publishes comprehensive documentation online:

- The ForgeRock Knowledge Base offers a large and increasing number of up-to-date, practical articles that help you deploy and manage ForgeRock software.

  While many articles are visible to community members, ForgeRock customers have access to much more, including advanced information for customers using ForgeRock software in a mission-critical capacity.

- ForgeRock product documentation, such as this document, aims to be technically accurate and complete with respect to the software documented. It is visible to everyone and covers all product features and examples of how to use them.

3. Using the ForgeRock.org Site

The ForgeRock.org site has links to source code for ForgeRock open source software, as well as links to the ForgeRock forums and technical blogs.

If you are a *ForgeRock customer*, raise a support ticket instead of using the forums. ForgeRock support professionals will get in touch to help you.

Chapter 1

Preparing to Install and Run Servers

This chapter covers the tasks required to prepare, install and start IDM.

Note

This documentation set includes a separate Samples Guide. When you have read the first two chapters of this document, use the *Samples Guide* to test a number of different deployment scenarios.

1.1. Before You Install

This section covers what you need to know before you install IDM.

1.1.1. Java Prerequisites

For details of the supported Java Environment, see "Preparing the Java Environment" in the *Release Notes*.

On Windows systems, you must set the `JAVA_HOME` environment variable to point to the root of a valid Java installation. The following steps indicate how to set the `JAVA_HOME` environment variable on Windows Server 2008 R2. Adjust the steps for your specific environment:

1. Locate your JRE Installation Directory. If you have not changed the installation path for the Java Runtime Environment during installation, it will be in a directory under `C:\Program Files\Java\`.
2. Select Start > Control Panel > System and Security > System.
3. Click Advanced System Settings.
4. Click Environment Variables.
5. Under System Variables, click New.
6. Enter the Variable name (`JAVA_HOME`) and set the Variable value to the JRE installation directory, for example `C:\Program Files\Java\jre8`.
7. Click OK.

On Linux systems, if `startup.sh` reports `JAVA_HOME not available, Java is needed to run IDM` and you've already installed Java, use the following steps to set `JAVA_HOME`:

1. Open the user shell configuration file found in your home directory.

2. Add the `JAVA_HOME` variable to the user shell configuration file, setting the value to `/usr`. In Bash, this would appear as `export JAVA_HOME="/usr"`.

1.1.2. Application Container

IDM runs in an OSGi container with an embedded Servlet container and an embedded noSQL database. By default the OSGi container is Apache Felix (Felix) and the default Servlet container is Jetty. No other configuration is supported.

1.2. Installing and Running Servers

Follow the procedures in this section to install and run IDM. To set up the server on a read-only volume, read "*Installing on a Read-Only Volume*".

To Install IDM

Follow these steps to install IDM:

1. Make sure you have an appropriate version of Java installed:

   ```
   $ java -version
   java version "1.8.0_121"
   Java(TM) SE Runtime Environment (build 1.8.0_121-b13)
   Java HotSpot(TM) 64-Bit Server VM (build 25.121-b13, mixed mode)
   ```

   For a description of the Java requirements, see "*Before You Install*" in the *Release Notes*.

2. Download IDM from the ForgeRock BackStage site. The ForgeRock BackStage site provides access to ForgeRock releases. These releases are thoroughly validated for ForgeRock customers who run the software in production deployments, and for those who want to try or test a given release.

3. Unpack the contents of the .zip file into the install directory:

   ```
   $ unzip ~/Downloads/IDM-6.0.0.7.zip
   Archive:  IDM-6.0.0.7.zip
     inflating: openidm/.checksums.csv
      creating: openidm/bundle/
    extracting: openidm/bundle/openidm-audit-6.0.0.7
   .jar
   ...
   ```

4. By default, IDM listens for HTTP and HTTPS connections on ports 8080 and 8443, respectively. To change the default port, edit your `resolver/boot.properties` file. For more information, see "*Host and Port Information*" in the *Integrator's Guide*.

   The hostname associated with IDM by default is `localhost`. To change the default hostname, edit the `openidm.host` property in your `resolver/boot.properties` file.

When you deploy IDM in production, you *must* set `openidm.host` to the URL of your deployment. If you do not do so, calls to the `/admin` endpoint are not redirected properly.

5. Before running IDM in production, replace the default embedded DS repository with a supported repository.

   For more information, see "*Selecting a Repository*".

To Start IDM

To run IDM as a background process, see "*Starting, Stopping, and Running the Server*" in the *Integrator's Guide*.

Follow these steps to run IDM interactively:

1. Start the Felix container, load all services, and start a command shell to allow you to manage the container:

   - Start IDM (UNIX):

   ```
   $ cd /path/to/openidm
   $ ./startup.sh

   Using OPENIDM_HOME:   /path/to/openidm
   Using PROJECT_HOME:   /path/to/openidm
   Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
   Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging
   .properties
   -> OpenIDM version "6.0.0.7"
   OpenIDM ready
   ```

   - Start IDM (Windows):

   ```
   C:\> cd \path\to\openidm
   C:\> startup.bat

   "Using OPENIDM_HOME:   \path\to\openidm"
   "Using PROJECT_HOME:   \path\to\openidm"
   "Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dfile.encoding=UTF-8"
   "Using LOGGING_CONFIG: -Djava.util.logging.config.file=\path\to\openidm\conf\logging
   .properties"
   -> OpenIDM version "6.0.0.7"
   OpenIDM ready
   ->
   ```

   At the OSGi console `->` prompt, you can enter commands such as **help** for usage, or **ps** to view the bundles installed. For a list of the core services and their states, run the following command:

```
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
[   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
[   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
[  10]   org.forgerock.openidm.datasource.jdbc  enabled
[  10]   org.forgerock.openidm.repo.jdbc  enabled
[  11]   org.forgerock.openidm.repo.ds  enabled
    [  48] [active      ] org.forgerock.openidm.repo
.ds
..
.
->
```

A default startup does not include certain configurable services, which will indicate an `unsatisfied` state until they are included in the configuration. As you work through the sample configurations described later in this guide, you will notice that these services are active.

Startup errors and messages are logged to the console by default. You can also view these messages in the log files at `/path/to/openidm/logs`.

2. Alternatively, you can manage the container and services from the Apache Felix Web Console.

   Use these hints to connect to the Apache Felix Web Console:

   - Default URL: https://localhost:8443/system/console
   - Default user name: `admin`
   - Default password: `admin`

   Select Main > Components to see core services and their respective states.

To Stop IDM

You can stop IDM from the `->` prompt in the OSGi console, or through the Apache Felix Web Console. Both of these options stop the Felix container.

1. In the OSGi console, enter the **shutdown** command at the `->` prompt:

   ```
   -> shutdown
   ...
   $
   ```

2. In the Apache Felix Web Console, select Web Console > System Information to stop the container.

3. On Unix systems, you can stop IDM by using the **shutdown.sh** script, located in the `/path/to/openidm` directory:

```
$ ./shutdown.sh
./shutdown.sh
Stopping OpenIDM (31391)
```

1.3. Installing IDM as a Service

The following sections describe how to install and run IDM as a service, on Windows and Linux systems:

1.3.1. Installing as a Windows Service

You can install IDM to run as a Windows service so that the server starts and stops automatically when Windows starts and stops. You must be logged in as an administrator to install a Windows service.

Note

On a 64-bit Windows server, you must have a 64-bit Java version installed to start the service. If a 32-bit Java version is installed, you will be able to install IDM as a service, but starting the service will fail.

Before you launch the `service.bat` file, which registers the service within the Windows registry, make sure that your `JAVA_HOME` environment variable points to a valid 64-bit version of the JRE or JDK. If you have already installed the service with the `JAVA_HOME` environment variable pointing to a 32-bit JRE or JDK, delete the service first, then reinstall the service.

1. Unpack the IDM-6.0.0.7.zip file, as described previously, and navigate to the *`install-directory`*`\bin` directory:

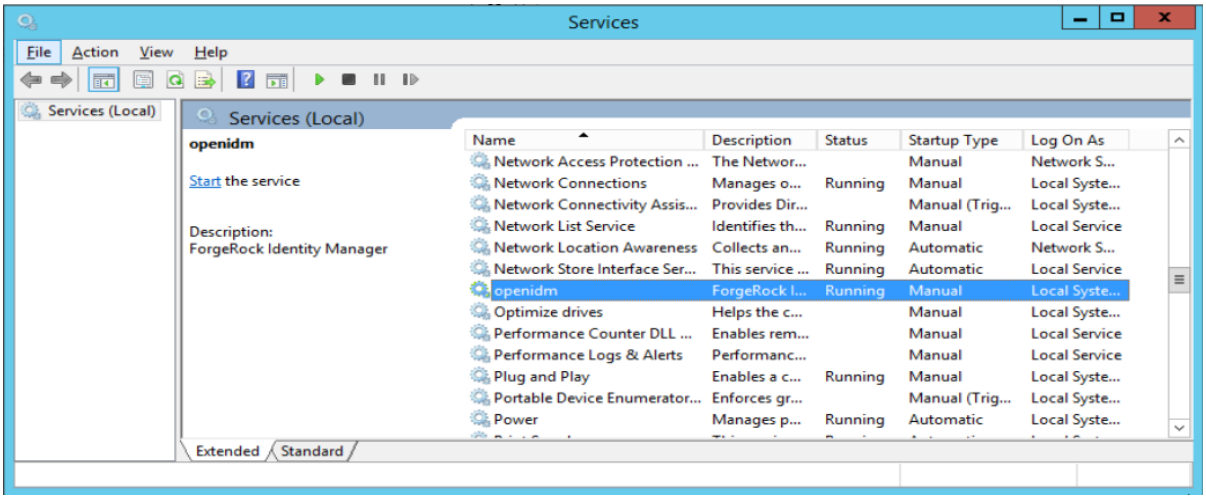
   ```
   C:\>cd openidm\bin
   C:\openidm\bin>
   ```

2. Run the `service.bat` command with the `/install` option, specifying the name that the service should run as:

   ```
   C:\openidm\bin>service.bat /install openidm
   ForgeRock Identity Management Server successfully installed as "openidm" service
   ```

3. Use the Windows Service manager to manage the IDM service.

Running as a Windows Service



4. By default, the IDM service is run by `Local System`, which is a system-level service account built in to Windows. Before deploying to production, it is recommended you switch to an account with fewer permissions. The account running the IDM service needs to be able to read, write, and execute only the directories related to IDM. For more information about service accounts, see Service Accounts in the Microsoft documentation.

5. Use the Windows Service Manager to start, stop, or restart the service.

6. If you want to uninstall the IDM service, first use the Windows Service Manager to stop IDM and then run the following command:

```
C:\install-directory\openidm\bin>service.bat /uninstall openidm
 Service "openidm" removed successfully
```

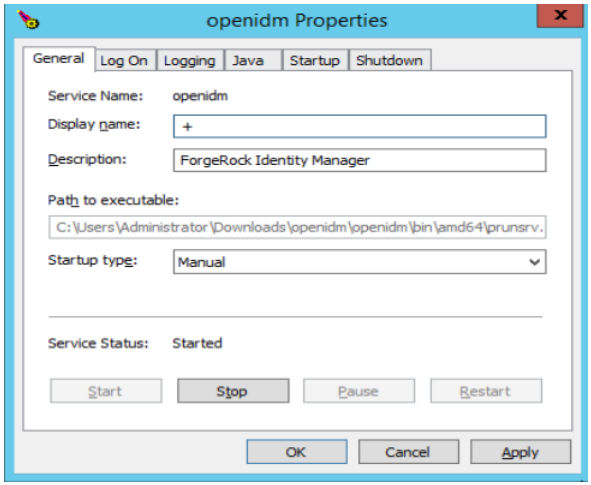
7. If desired, you can then set up IDM with a specific project directory:

```
C:\install-directory\openidm\bin>service.bat /install openidm -p C:\project-directory
ForgeRock Identity Management Server successfully installed as "openidm" service
```

You can also manage configuration details with the Procrun monitor application. IDM includes the associated `prunmgr.exe` executable in the `C:\install-directory\openidm\bin` directory.

For example, you can open the Windows service configuration application for IDM with the following command, where `ES` stands for *Edit Service Configuration*

```
C:\install-directory\openidm\bin>prunmgr.exe //ES/openidm
```



The `prunmgr.exe` executable also includes the monitor application functionality described in the following Apache Commons page on the: *Procrun monitor Application*. However, IDM does not include the Procrun service application.

For example, if you've configured IDM as a Windows service, you can start and stop it with the following commands:

```
C:\install-directory\openidm\bin>prunmgr.exe //MR/openidm
C:\install-directory\openidm\bin>prunmgr.exe //MQ/openidm
```

In these commands, `MR` is the option to *Monitor and Run* IDM, and `MQ` stands for *Monitor Quit*, which stops the IDM service.

1.3.2. Installing as a Linux Service

IDM provides a script that can generate `SysV` or `Systemd` service initialization scripts. You can start the script as the root user, or configure it to start during the boot process.

When IDM runs as a service, logs are written to the installation directory.

1. If you have not yet installed IDM, follow the steps in "To Install IDM".

2. Review the options by running the following script:

```
$ cd /path/to/openidm/bin
$ ./create-openidm-rc.sh
Usage: ./create-openidm-rc.sh --[systemd|chkconfig|lsb]
Outputs OpenIDM init file to stdout for the given system

--systemd    Generate Systemd init script. This is preferred for all modern distros
.
--chkconfig  Generate SysV init script with chkconfig headers (RedHat/
CentOS)
--lsb        Generate SysV init script with LSB headers (Debian/
Ubuntu)
...
```

The following sections describe how you can create each of these scripts:

1.3.2.1. Setting up a Systemd Service

If you're running relatively standard versions of Red Hat Enterprise Linux (CentOS Linux) version 7.x, or Ubuntu 16.04 and later, you'll want to set up a systemd service script. To set up such a script, navigate to the `/path/to/openidm/bin` directory, and run the following command:

```
$ ./create-openidm-rc.sh --systemd
```

As noted in the output, you can set up the IDM service on a standard systemd-based Linux distribution with the following commands:

```
$ ./create-openidm-rc.sh --systemd > openidm.service
$ sudo cp openidm.service /etc/systemd/system/
$ systemctl enable openidm
$ systemctl start openidm
```

To stop the IDM service, run the following command:

```
$ systemctl stop openidm
```

You can modify the `openidm.service` script. The following excerpt would run IDM with a startup script in the `/home/idm/project` directory:

```
[Unit]
Description=ForgeRock OpenIDM
After=network.target auditd.target

[Service]
Type=simple
SuccessExitStatus=143
Environment=JAVA_HOME=/usr
ExecStart=/root/openidm/startup.sh -p /home/idm/project
ExecStop=/root/openidm/shutdown.sh

[Install]
WantedBy=multi-user.target
```

Run the following commands to reload the configuration and then start the IDM service script:

```
$ systemctl daemon-reload
$ systemctl start openidm
```

1.3.2.2. Setting up a SysV Service (Red Hat)

If you're running relatively standard versions of Red Hat Enterprise Linux (CentOS Linux) version 6.x, you'll want to set up a SysV service script, with runlevels controlled through the **chkconfig** command. To set up such a script, navigate to the `/path/to/openidm/bin` directory, and run the following command:

```
$ ./create-openidm-rc.sh --chkconfig
```

You can then set up and start the IDM service on a Linux distribution that uses SysV init scripts, with the following commands:

```
$ ./create-openidm-rc.sh --chkconfig  > openidm
$ sudo cp openidm /etc/init.d/
$ sudo chmod u+x /etc/init.d/openidm
$ sudo chkconfig --add openidm
$ sudo chkconfig openidm on
$ sudo service openidm start
```

To stop the IDM service, run the following command:

```
$ sudo service openidm stop
```

You can modify the `/etc/init.d/openidm` script. The following excerpt would run IDM with the `startup.sh` script in the `/path/to/openidm` directory:

```
START_CMD="PATH=$JAVA_BIN_PATH:$PATH;nohup $OPENIDM_HOME/startup.sh >$OPENIDM_HOME/logs/server.out 2>&1 &"
```

You can modify this line to point to some `/path/to/production` directory:

```
START_CMD="PATH=$JAVA_BIN_PATH:$PATH;nohup $OPENIDM_HOME/startup.sh -p /path/to/production >$OPENIDM_HOME/
logs/server.out 2>&1 &"
```

Run the following commands to reload the configuration and then start the IDM service script:

```
$ sudo service openidm start
```

If you run Linux with SELinux enabled, change the file context of the newly copied script with the following command:

```
$ sudo restorecon /etc/init.d/openidm
```

Verify the change to SELinux contexts with the `ls -Z /etc/init.d` command. For consistency, change the user context to match other scripts in the same directory with the `sudo chcon -u system_u /etc/init.d/openidm` command.

1.3.2.3. Setting up a SysV Service (Ubuntu)

If you're running relatively standard older versions of Ubuntu Linux, versions which support SysV services, you'll want to set up a SysV service script, with runlevels controlled through the **update-rc.d**

command. To set up such a script, navigate to the `/path/to/openidm/bin` directory, and run the following command:

```
$ ./create-openidm-rc.sh --lsb
```

You can then set up and start the IDM service on a Linux distribution that uses SysV init scripts, with the following commands:

```
$ ./create-openidm-rc.sh --lsb  > openidm
      $ sudo cp openidm /etc/init.d/
      $ sudo chmod u+x /etc/init.d/openidm
      $ sudo update-rc.d openidm defaults
      $ sudo service openidm start
```

To stop the IDM service, run the following command:

```
$ sudo service openidm stop
```

You can modify the `/etc/init.d/openidm` script. The following excerpt would run IDM with the `startup.sh` script in the `/path/to/openidm` directory:

```
START_CMD="PATH=$JAVA_BIN_PATH:$PATH;nohup $OPENIDM_HOME/startup.sh >$OPENIDM_HOME/logs/server.out 2>&1 &"
```

You can modify this line to point to some `/path/to/production` directory:

```
START_CMD="PATH=$JAVA_BIN_PATH:$PATH;nohup $OPENIDM_HOME/startup.sh -p /path/to/production >$OPENIDM_HOME/
logs/server.out 2>&1 &"
```

You can then run the following commands to reload the configuration and then start the IDM service script:

```
$ sudo service openidm restart
```

1.4. Getting Started With the REST Interface

IDM provides RESTful access to users in its repository. To access the repository over REST, you can use a browser-based REST client, such as the *Simple REST Client* for Chrome, or *RESTClient* for Firefox. Alternatively you can use the **curl** command-line utility that is included with most operating systems. For more information about **curl**, see https://github.com/bagder/curl.

IDM is accessible over the regular and secure HTTP ports of the Jetty Servlet container, 8080, and 8443. Most of the command-line examples in this documentation set use the regular HTTP port, to avoid you having to use certificates just to test IDM. In a production deployment, install a CA-signed certificate and restrict REST access to a secure (HTTPS) port.

To run **curl** over the secure port, 8443, you must either include the **--insecure** option, or follow the instructions in "Restricting REST Access to the HTTPS Port" in the *Integrator's Guide*. You can use

those instructions with the self-signed certificate that is generated when IDM starts, or with a `*.crt` file provided by a certificate authority.

Note

Some of the examples in this documentation set use client-assigned IDs when creating resources, as it makes the examples easier to read. In general, immutable server-assigned UUIDs should be used in production.

1. Access the following URL to obtain the JSON representation of all users in the IDM repository:

```
$ curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request GET \
 http://localhost:8080/openidm/managed/user/?_queryId=query-all-ids
```

   When you first install IDM with an empty repository, no users exist.

2. Create a user `joe` by sending a RESTful POST.

   The following **curl** commands create the user `joe` in the repository.

   - Create `joe` (UNIX):

```
$ curl \
 --header "Content-Type: application/json" \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request POST \
 --data '{
 "userName":"joe",
 "givenName":"joe",
 "sn":"smith",
 "mail":"joe@example.com",
 "telephoneNumber":"555-123-1234",
 "password":"TestPassw0rd",
 "description":"My first user",
 "_id":"joe"
 }' \
 http://localhost:8080/openidm/managed/user?_action=create
{
  "_id": "joe",
  "_rev": "00000000c03fd7aa",
  "userName": "joe",
  "givenName": "joe",
  "sn": "smith",
  "mail": "joe@example.com",
  "telephoneNumber": "555-123-1234",
  "description": "My first user",
  "accountStatus": "active",
  "effectiveRoles": [],
  "effectiveAssignments": []
}
```

   - Create `joe` (Windows):

```
C:\> curl ^
 --header "Content-Type: application/json" ^
 --header "X-OpenIDM-Username: openidm-admin" ^
 --header "X-OpenIDM-Password: openidm-admin" ^
 --request POST ^
 --data "{
 \"userName\":\"joe\",
 \"givenName\":\"joe\",
 \"sn\":\"smith\",
 \"mail\":\"joe@example.com\",
 \"telephoneNumber\":\"555-123-1234\",
 \"password\":\"TestPassw0rd\",
 \"description\":\"My first user\",
 \"_id\":\"joe\"
 }" ^
 http://localhost:8080/openidm/managed/user?_action=create
```

3. Fetch the newly created user from the repository with a RESTful GET:

```
$ curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request GET \
 http://localhost:8080/openidm/managed/user/joe
{
  "_id": "joe",
  "_rev": "00000000c03fd7aa",
  "userName": "joe",
  "givenName": "joe",
  "sn": "smith",
  "mail": "joe@example.com",
  "telephoneNumber": "555-123-1234",
  "description": "My first user",
  "accountStatus": "active",
  "effectiveRoles": [],
  "effectiveAssignments": []
}
```

1.4.1. Format REST Output For Readability

By default, **curl**-based REST calls return the JSON object on one line.

Without a bit of help, the JSON output is formatted all on one line. One example is shown below, and it is difficult to read:

```
{"mail":"joe@example.com","sn":"smith","passwordAttempts":"0",
"lastPasswordAttempt":"Mon Apr 14 2014 11:13:37 GMT-0800 (GMT-08:00)",
"address2":"","givenName":"joe","effectiveRoles":["openidm-authorized"],
"password":{"$crypto":{"type":"x-simple-encryption","value":{"data":
"OBFVL9cG8uaLoo1N+SMJ3g==","cipher":"AES/CBC/PKCS5Padding","iv":
"7rlV4EwkwdRHkt19F8g22A==","key":"openidm-sym-default"}}},"country":"",
"city":"","_rev": "00000000c03fd7aa","lastPasswordSet":"","postalCode":"",
"_id":"joe3","description":"My first user","accountStatus":"active","telephoneNumber":
"555-123-1234","roles":["openidm-authorized"],"effectiveAssignments":{},
"postalAddress":"","stateProvince":"","userName":"joe3"}
```

At least two options are available to clean up this output.

The standard way to format JSON output is with a JSON parser such as jq. You can "pipe" the output of a REST call to **jq**, as follows:

```
$ curl \
--header "X-OpenIDM-Username: openidm-admin"
 \
--header "X-OpenIDM-Password: openidm-admin"
 \
--request GET \
"http://localhost:8080/openidm/managed/user/joe" \
| jq .
```

The ForgeRock REST API includes an optional `_prettyPrint` request parameter. The default value is `false`. To use the ForgeRock REST API to format output, add a parameter such as `?_prettyPrint=true` or `&_prettyPrint=true`, depending on whether it is added to the end of an existing request parameter. In this case, the following command would return formatted output:

```
$ curl \
--header "X-OpenIDM-Username: openidm-admin"
 \
--header "X-OpenIDM-Password: openidm-admin"
 \
--request GET \
"http://localhost:8080/openidm/managed/user/joe?_prettyPrint=true"
```

Note that most command-line examples in this guide do not show this parameter, although the output is formatted for readability.

1.5. IDM User Interfaces

You can manage IDM using Web-based user interfaces, called the UI in this documentation set.

IDM provides UIs at two different endpoints, `/` and `/admin`. We refer to the administrative tools available at each endpoint as the Self-Service UI and the Administrative UI (Admin UI), respectively.

The Self-Service UI allows regular (non-administrative) users to update parts of their profile, such as passwords and addresses. For more information, see "*Configuring User Self-Service*" in the *Integrator's Guide*. When these features are enabled, anonymous users can self-register and regular users can reset their own passwords.

In addition, administrative users can configure and manage workflows. For more information, see "Managing User Access to Workflows" in the *Integrator's Guide*.

In essence, the Self-Service UI supports day-to-day administrative tasks.

In contrast, the Admin UI allows an administrator to define the server configuration. Administrators would access the Admin UI to learn about IDM during initial system setup, and when they identify new requirements.

The Admin UI also enables you to configure connections to external data stores, and to specify the reconciliation and synchronization configuration between data stores.

When IDM is running on the localhost system, you can access these UIs at `https://localhost:8443/` and `https://localhost:8443/admin`, respectively.

1.6. About the Repository

By default, IDM installs an embedded ForgeRock Directory Services (DS) instance for use as its repository. This makes it easy to get started. Before you use IDM in production, you must replace the embedded DS repository with a supported repository. For more information, see "*Selecting a Repository*".

You can query the internal repository directly by using the LDAP command-line utilities provided with DS. For example, the following command returns all the objects in the repository of a default IDM project:

```
$ ldapsearch \
 --hostname localhost \
 --port 31389 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --baseDN "dc=openidm,dc=forgerock,dc=com" \
 "(objectclass=*)"

dn: dc=openidm,dc=forgerock,dc=com
objectClass: top
objectClass: domain
dc: openidm

dn: ou=links,dc=openidm,dc=forgerock,dc=com
objectClass: top
objectClass: organizationalUnit
ou: links

dn: ou=internal,dc=openidm,dc=forgerock,dc=com
objectClass: top
objectClass: organizationalUnit
ou: internal

dn: ou=users,ou=internal,dc=openidm,dc=forgerock,dc=com
objectClass: top
objectClass: organizationalUnit
ou: users
...
```

For more information about the DS command-line utilities, see the *DS Tools Reference*.

1.7. Starting a New Project

When you extract the IDM .zip file, you have a default project under `/path/to/openidm`. You can use this project to test customizations, but you should not run the default project in production.

Set up a new project as follows:

1. Create a directory for your new project:

   ```
   $ mkdir /path/to/my-project
   ```

   Note that the automated update process does not work for projects that are subdirectories of the default project. You should therefore create your new project directory somewhere outside of `/path/to/openidm/`.

2. Set up a minimal configuration:

   - If your project will be similar to any of the sample configurations (described in the Samples Guide) copy the contents of the sample to your new project.

     For example:

     ```
     $ cp -r /path/to/openidm/samples/sync-with-ldap/* /path/to/my-project/
     ```

     You can then customize the sample configuration according to your requirements.

   - If you do not want to start with one of the sample configurations, copy the `conf/` and `script/` directories from the default project to your new project directory:

     ```
     $ cd /path/to/openidm
     $ cp -pr conf /path/to/my-project/
     $ cp -pr script /path/to/my-project/
     ```

     You can then customize the basic configuration according to your requirements.

3. Start your new project as follows:

   ```
   $ cd /path/to/openidm
   $ ./startup.sh -p /path/to/my-project
   ```

Chapter 2
Selecting a Repository

By default, IDM uses an embedded ForgeRock Directory Services (DS) instance for its internal repository. This means that you do not need to install a database in order to evaluate the software. Before using IDM in production, however, you must replace the embedded DS repository with a supported repository.

In production environments, the following repositories are supported:

External DS instance

See "Using an External DS Repository".

> **Important**
>
> Both the default embedded and the external DS repositories do *not* support storage of audit data. Audit logging to the repository is disabled by default. Do not enable logging to the repository if you are using a DS repository.

MySQL

See "Setting Up a MySQL Repository".

MariaDB

The instructions in "Setting Up a MySQL Repository" work equally well for MariaDB.

Microsoft SQL

See "Setting Up an MS SQL Repository".

PostgreSQL

See "Setting Up a PostgreSQL Repository".

Oracle Database (Oracle DB)

See "Setting Up an Oracle DB Repository".

IBM DB2 Database

See "Setting Up an IBM DB2 Repository".

For supported versions, see "Supported Repositories" in the *Release Notes*.

This chapter describes how to set up IDM to work with each of these supported repositories, and lists the minimum rights required for database installation and operation.

For information about the repository configuration, and how to map IDM objects to database tables or to DS LDAP objects, see "*Managing the Repository*" in the *Integrator's Guide*.

2.1. Using the Default DS Repository

By default, IDM uses the `conf/repo.ds.json` file to start an embedded DS instance. The embedded DS repository is not supported in production environments.

The embedded DS server has the following configuration by default:

- `hostname` - `localhost`
- `ldapPort` - `31389`
- `bindDN` - `cn=Directory Manager`
- `bindPassword` - `password`
- `adminPort` - `34444`

To change the administrative port of the embedded DS server, add an `adminPort` property to your project's `conf/repo.ds.json` file before you start IDM. To change any of the other default values, add an `ldapConnectionFactories` property, as shown in the following example.

This excerpt of a `repo.ds.json` sets the administrative port to `4444`. The example changes the bind password to `MyPassw0rd` but shows the structure of the entire `ldapConnectionFactories` property for reference:

```
{
  "embedded": true,
  "maxConnectionAttempts" : 5,
  "adminPort": 4444,
  "ldapConnectionFactories": {
    "bind": {
      "primaryLdapServers": [{ "hostname": "localhost", "port": 31389 }]
    },
    "root": {
      "authentication": {
        "simple": { "bindDn": "cn=Directory Manager", "bindPassword": "MyPassw0rd" }
      }
    }
  },
  "queries": {
...
```

It is not necessary to add the entire `ldapConnectionFactories` block to your configuration file but you must respect the JSON structure. For example, to change only the `hostname`, you would need to add at least the following:

```
{
  ...
  "ldapConnectionFactories": {
    "bind": {
      "primaryLdapServers": [{ "hostname": "my-hostname" }]
    }
  },
  "queries": {
...
```

If you do not specify a connection property here, IDM assumes the default.

You can also configure an external DS instance as a repository. For more information, see "Using an External DS Repository".

Note

If you are running Red Hat Enterprise Linux 6 or an AWS-based Ubuntu 16.04 system and do not have your own public key certificate, include the hostname of your system in your `/etc/hosts` file. Otherwise, an attempt to start IDM will fail with an `UnknownHostException` error.

2.2. Using an External DS Repository

IDM supports the use of a single external DS instance as a repository. You can use a replicated instance for backup purposes, but using multiple replicated instances (in a multimaster DS deployment) is not supported.

To configure a new or existing DS instance as an external repository, follow these steps:

1. If you have not yet installed DS, download it from ForgeRock's BackStage site and extract the zip archive.

2. Set up DS with a base DN entry of `dc=openidm,dc=forgerock,dc=com`.

```
$ cd /path/to/opendj
$ ./setup directory-server \
 --rootUserDN "cn=Directory Manager" \
 --rootUserPassword password \
 --hostname localhost \
 --ldapPort 31389 \
 --adminConnectorPort 34444 \
 --baseDN dc=openidm,dc=forgerock,dc=com \
 --acceptLicense
Validating parameters..... Done
Configuring certificates..... Done
Configuring server..... Done

To see basic server status and configuration, you can
 launch
/path/to/opendj/bin/status
```

This command configures DS on the localhost, listening on ports `31389` and `34444` so that it does not conflict with the default ports used in the LDAP samples. You can use any available ports in the setup. If you use a different host and an LDAP port other than `31389`, change the `primaryLdapServers` property in your `repo.ds-external.json` file accordingly.

3. Create the matching rules required to set up indexes for the default IDM data:

```
$ ./bin/dsconfig \
 create-schema-provider \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --provider-name "IDM managed/user Json Schema" \
 --type json-query-equality-matching-rule \
 --set enabled:true \
 --set case-sensitive-strings:false \
 --set ignore-white-space:true \
 --set matching-rule-name:caseIgnoreJsonQueryMatchManagedUser \
 --set matching-rule-oid:1.3.6.1.4.1.36733.2.3.4.1  \
 --set indexed-field:userName \
 --set indexed-field:givenName \
 --set indexed-field:sn \
 --set indexed-field:mail \
 --set indexed-field:accountStatus \
 --trustAll \
 --no-prompt
The JSON Query Equality Matching Rule was created successfully

$ ./bin/dsconfig \
 create-schema-provider \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --provider-name "IDM managed/role Json Schema" \
 --type json-query-equality-matching-rule \
 --set enabled:true \
 --set case-sensitive-strings:false \
 --set ignore-white-space:true \
 --set matching-rule-name:caseIgnoreJsonQueryMatchManagedRole \
 --set matching-rule-oid:1.3.6.1.4.1.36733.2.3.4.2  \
 --set indexed-field:"condition/**" \
 --set indexed-field:"temporalConstraints/**" \
 --trustAll \
 --no-prompt
The JSON Query Equality Matching Rule was created successfully

$ ./bin/dsconfig \
 create-schema-provider \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --provider-name "IDM Relationship Json Schema" \
 --type json-query-equality-matching-rule \
 --set enabled:true \
```

```
 --set case-sensitive-strings:false \
 --set ignore-white-space:true \
 --set matching-rule-name:caseIgnoreJsonQueryMatchRelationship \
 --set matching-rule-oid:1.3.6.1.4.1.36733.2.3.4.3  \
 --set indexed-field:firstResourceCollection \
 --set indexed-field:firstResourceId \
 --set indexed-field:firstPropertyName \
 --set indexed-field:secondResourceCollection \
 --set indexed-field:secondResourceId \
 --set indexed-field:secondPropertyName \
 --trustAll \
 --no-prompt
The JSON Query Equality Matching Rule was created successfully

$ ./bin/dsconfig \
 create-schema-provider \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --provider-name "IDM Cluster Object Json Schema" \
 --type json-query-equality-matching-rule \
 --set enabled:true \
 --set case-sensitive-strings:false \
 --set ignore-white-space:true \
 --set matching-rule-name:caseIgnoreJsonQueryMatchClusterObject \
 --set matching-rule-oid:1.3.6.1.4.1.36733.2.3.4.4  \
 --set indexed-field:"timestamp" \
 --set indexed-field:"state" \
 --trustAll \
 --no-prompt
The JSON Query Equality Matching Rule was created successfully
```

4. Copy the IDM LDIF schema to the DS schema folder. To ensure that the schema definitions for IDM load only after all of the DS schema files installed by default, rename the file with a number higher than the default DS schema files. This example renames the file to `99-openidm.ldif`:

```
$ cp /path/to/openidm/db/ds/schema/openidm.ldif db/schema/99-openidm.ldif
```

5. Restart DS to load the new schema:

```
$ bin/stop-ds --restart
Stopping Server...
[02/Mar/2018:15:14:53 -0800] category=BACKEND severity=NOTICE msgID=370 msg=The backend userRoot is
 now taken
 offline
...
[02/Mar/2018:15:15:12 -0800] category=CORE severity=NOTICE msgID=139 ... The Directory Server has
 started successfully
```

6. Create the required indexes:

```
$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
```

```
 --backend-name userRoot \
 --index-name fr-idm-managed-user-json \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-managed-role-json \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-relationship-json \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-cluster-json \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-json \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully
```

```
$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-link-type \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-link-firstid \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-link-secondid \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully

$ bin/dsconfig \
 create-backend-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --backend-name userRoot \
 --index-name fr-idm-link-qualifier \
 --set index-type:equality \
 --trustAll \
 --no-prompt
The Backend Index was created successfully
```

Finally, rebuild the indexes:

```
$ bin/rebuild-index \
 --hostname localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --baseDN dc=openidm,dc=forgerock,dc=com \
 --rebuildAll \
 --start 0 \
 --trustAll
Rebuild Index task 20180302154417277 scheduled to start 02 Mar 2018 3:44:17 PM
```

7. Import the `populate_users.ldif` file into DS to set up the default entries required by IDM:

```
$ bin/import-ldif \
 --ldifFile /path/to/openidm/db/ds/scripts/populate_users.ldif \
 --backendID userRoot \
 --hostName localhost \
 --port 34444 \
 --bindDN "cn=Directory Manager" \
 --bindPassword password \
 --trustAll \
 --noPropertiesFile
Import task 20180302154533707 scheduled to start immediately
...
Import task 20180302154533707 has been successfully completed
```

   Your DS instance is now ready to be used as an external repository.

8. In your IDM installation, remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

```
$ cd /path/to/openidm/my-project/conf/
$ rm repo.ds.json
```

9. Copy the external DS repository configuration file (`repo.ds-external.json`) to your project's `conf` directory and rename it `repo.ds.json`:

```
$ cd /path/to/openidm/
$ cp db/ds/conf/repo.ds-external.json my-project/conf/repo.ds.json
```

10. If your DS instance is *not* running on the localhost and listening for LDAP connections on port `31389`, adjust the `primaryLdapServers` property in that file to match your DS setup.

11. Start IDM with the configuration for your project. For example:

```
$ cd /path/to/openidm
 $ ./startup.sh -p my-project
 Executing ./startup.sh...
 Using OPENIDM_HOME:   /path/to/openidm
 Using PROJECT_HOME:   /path/to/my-project
 Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
 Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/my-project/conf/logging.properties
 -> OpenIDM version "6.0.0.7"
 OpenIDM ready
```

2.3. Database Access Rights For a JDBC Repository

In general, IDM requires minimal access rights to the JDBC repository for daily operation. This section lists the minimum permissions required, and suggests a strategy for restricting database access in your deployment.

The JDBC repository used by IDM requires only one *relevant* user - the service account that is used to create the tables. Generally, the details of this account are configured in the repository connection file (`datasource.jdbc-default.json`). By default, the username and password for this account are `openidm` and `openidm`, regardless of the database type.

All other users are created by the `db/database-type/scripts/openidm.sql` script. The `openidm` user account must have SELECT, UPDATE, INSERT, and DELETE permissions on all the openidm tables that are created by this script, by the scripts that create the tables specific to the Activiti workflow engine, and by the script that sets up the audit tables if you are using the repository audit event handler.

2.4. Setting Up a MySQL Repository

After you have installed MySQL on the local host and *before starting IDM for the first time*, configure the server to use the new repository, as described in the following sections.

This procedure assumes that a password has already been set for the MySQL root user:

1. Download MySQL Connector/J, version 5.1 or later from the MySQL website. Unpack the delivery, and copy the .jar into the `openidm/bundle` directory:

   ```
   $ cp mysql-connector-java-version-bin.jar /path/to/openidm/bundle/
   ```

2. Make sure that IDM is stopped:

   ```
   $ cd /path/to/openidm/
   $ ./shutdown.sh
   OpenIDM is not running, not stopping.
   ```

3. Remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

   ```
   $ cd /path/to/openidm/my-project/conf/
   $ rm repo.ds.json
   ```

4. Copy the MySQL database connection configuration file (`datasource.jdbc-default.json`) and the database table configuration file (`repo.jdbc.json`) to your project's `conf` directory:

   ```
   $ cd /path/to/openidm/
   $ cp db/mysql/conf/datasource.jdbc-default.json my-project/conf/
   $ cp db/mysql/conf/repo.jdbc.json my-project/conf/
   ```

5. If you have previously set up a MySQL repository for IDM, you *must* drop the openidm database and users before you continue:

```
mysql> drop database openidm;
Query OK, 21 rows affected (0.63 sec)
mysql> drop user openidm;
Query OK, 0 rows affected (0.02 sec)
mysql> drop user openidm@localhost;
Query OK, 0 rows affected (0.00 sec)
```

6. Import the IDM data definition language script into MySQL:

```
$ cd /path/to/mysql
$ mysql -u root -p < /path/to/openidm/db/mysql/scripts/openidm.sql
Enter password:
$
```

Note

If you see errors like `Access denied for user 'root'@'localhost'`, and are deploying on a *new* installation of Ubuntu 16.04 and above, the UNIX_SOCKET plugin may be installed, which applies Linux `root` credentials to MySQL. In that case, substitute **sudo mysql -u root** for **mysql -u root -p** in the commands in this section.

This step creates an `openidm` database for use as the internal repository, and a user `openidm` with password `openidm` who has all the required privileges to update the database:

```
$ mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 18
Server version: 5.5.19 MySQL Community Server
 (GPL)
...
mysql> use openidm;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;

+---------------------------+
| Tables_in_openidm         |
+---------------------------+
| clusteredrecontargetids   |
| clusterobjectproperties   |
| clusterobjects            |
| configobjectproperties    |
| configobjects             |
| genericobjectproperties   |
| genericobjects            |
| ...                       |
| schedulerobjects          |
| schedulerobjectproperties |
| uinotification            |
| updateobjectproperties    |
| updateobjects             |
+---------------------------+
```

Exit the mysql console.

```
mysql> exit
Bye
```

7. Create the IDM database user.

   If you are running MySQL 5.7 or higher, run the following script:

   ```
   $ cd /path/to/mysql
   $ mysql -u root -p < /path/to/openidm/db/mysql/scripts/createuser.sql
   Enter password:
   ```

   If you are running a MySQL version prior to 5.7, run the following script:

   ```
   $ cd /path/to/mysql
   $ mysql -u root -p < /path/to/openidm/db/mysql/scripts/createuser.mysql56.sql
   Enter password:
   ```

8. Run the three scripts that set up the tables required by the Activiti workflow engine.

   If you are running MySQL 5.6.4 or higher, run the following scripts:

   ```
   $ cd /path/to/mysql
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql.create.engine.sql
   Enter password:
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql.create.history.sql
   Enter password:
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql.create.identity.sql
   Enter password:
   ```

   If you are running a MySQL version prior to 5.6.4, run the following scripts:

   ```
   $ cd /path/to/mysql
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql55.create.engine.sql
   Enter password:
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql55.create.history.sql
   Enter password:
   $ mysql -D openidm -u root -p < /path/to/openidm/db/mysql/scripts/activiti.mysql.create.identity.sql
   Enter password:
   ```

9. If you are planning to direct audit logs to this repository, run the script that sets up the audit tables:

   ```
   $ mysql -D openidm -u root -p < openidm/db/mysql/scripts/audit.sql
   Enter password:
   ```

10. Update the connection configuration to reflect your MySQL deployment. The default connection configuration in the `datasource.jdbc-default.json` file is as follows:

```
{
    "driverClass" : "com.mysql.jdbc.Driver",
    "jdbcUrl" : "jdbc:mysql://&{openidm.repo.host}:&{openidm.repo.port}/openidm?
allowMultiQueries=true&characterEncoding=utf8",
    "databaseName" : "openidm",
    "username" : "openidm",
    "password" : "openidm",
    "connectionTimeout" : 30000,
    "connectionPool" : {
        "type" : "hikari",
        "minimumIdle" : 20,
        "maximumPoolSize" : 50
    }
}
```

Specify the values for `openidm.repo.host` and `openidm.repo.port` in one of the following ways:

- Set the values in `resolver/boot.properties` or your project's `conf/system.properties` file, for example:

  ```
  openidm.repo.host = localhost
  openidm.repo.port = 3306
  ```

- Set the properties in the `OPENIDM_OPTS` environment variable and export that variable before startup. You must include the JVM memory options when you set this variable. For example:

  ```
  $ export OPENIDM_OPTS="-Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=3306"
  $ ./startup.sh -p /path/to/openidm/my-project
  Executing ./startup.sh...
  Using OPENIDM_HOME:   /path/to/openidm
  Using PROJECT_HOME:   /path/to/openidm
  Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=3306
  Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
  Using boot properties at /path/to/openidm/resolver/boot
  .properties
  -> OpenIDM version "6.0.0.7"
  OpenIDM ready
  ```

Tip

If you're working in a production environment, set up SSL, as described in the *MySQL Connector Developer Guide*. If you're using an older version of MySQL, add `&useSSL=true` to the end of the `jdbcURL`.

If you're running a relatively recent version of MySQL (5.5.45+, 5.6.26+, 5.7.6+), the default configuration expects you to set up SSL, unless you add `&useSSL=false` to the end of the `jdbcUrl`.

When you have set up MySQL for use as the internal repository, start the server to check that the setup has been successful. After startup, you should see that `repo.jdbc` is `active`, whereas `repo.ds` is `enabled` but not `active`:

```
$ cd /path/to/openidm
  $ ./startup.sh -p my-project
Using OPENIDM_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
Using LOGGING_CONFIG:
-Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot.properties
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
 [   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
 [   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
 [  10]   org.forgerock.openidm.datasource.jdbc  enabled
 [  10]   org.forgerock.openidm.repo.jdbc  enabled
    [  48] [active      ] org.forgerock.openidm.repo.jdbc
 [  11]   org.forgerock.openidm.repo.ds
 enabled
...
```

2.5. Setting Up an MS SQL Repository

These instructions are specific to MS SQL Server 2012 R2 Standard Edition, running on a Windows Server 2012 R2 system. Adapt the instructions for your environment.

When you install Microsoft SQL Server, pay attention to the following specific configuration requirements:

- During the Feature Selection installation step, make sure that at least SQL Server Replication, Full Text Search, and Management Tools - Basic are selected.

  These instructions require SQL Management Studio so make sure that you include Management Tools in the installation.

- During the Database Engine Configuration step, select Mixed Mode (SQL Server authentication and Windows authentication). IDM *requires* SQL Server authentication.

- TCP/IP must be enabled and configured for the correct IP address and port. To configure TCP/IP, follow these steps:

  1. Navigate to SQL Server Configuration Manager.

  2. Expand the SQL Server Network Configuration item and select "Protocols for MSSQLSERVER".

  3. Check that TCP/IP is Enabled.

  4. Select the IP Addresses tab and set the addresses and ports on which the server will listen.

     For this sample procedure, scroll down to IPAll and set TCP Dynamic Ports to 1433 (the default port for MS SQL).

5. Click OK.

6. Restart MS SQL Server for the configuration changes to take effect.

   To restart the server, select SQL Server Services in the left pane, double click SQL Server (MSSQLSERVER) and click Restart.

7. If you have a firewall enabled, ensure that the port you configured in the previous step is open for IDM to access MS SQL.

After you have installed MS SQL on the local host, install IDM, if you have not already done so, but *do not start* the instance. Import the data definition and configure IDM to use the MS SQL repository, as described in the following steps:

1. Use SQL Management Studio to import the IDM data definition language script into MS SQL:

   a. Navigate to SQL Server Management Studio.

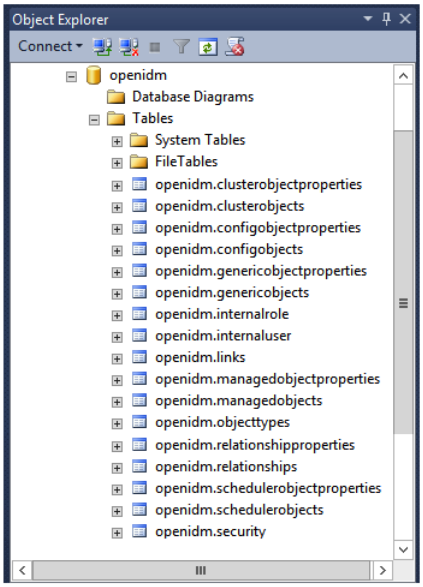
   b. On the Connect to Server panel, select Windows Authentication and click Connect.

   c. Select File > Open > File and navigate to the data definition language script (`path\to\openidm\db\mssql\scripts\openidm.sql`). Click Open to open the file.

   d. Click Execute to run the script.

2. This step creates an `openidm` database for use as the internal repository, and a user `openidm` with password `openidm` who has all the required privileges to update the database. You might need to refresh the view in SQL Server Management Studio to see the `openidm` database in the Object Explorer.

   Expand Databases > openidm > Tables. You should see the IDM tables in the openidm database, as shown in the following example.



3. Execute the three scripts that set up the tables required by the Activiti workflow engine:

   You can use the `sqlcmd` command to execute the scripts, for example:

```
PS C:\Users\Administrator> sqlcmd -S localhost -d openidm ^
    -i C:\path\to\openidm\db\mssql\scripts\activiti.mssql.create.engine.sql
PS C:\Users\Administrator> sqlcmd -S localhost -d openidm ^
    -i C:\path\to\openidm\db\mssql\scripts\activiti.mssql.create.history.sql
PS C:\Users\Administrator> sqlcmd -S localhost -d openidm ^
    -i C:\path\to\openidm\db\mssql\scripts\activiti.mssql.create.identity.sql
```

   Note

   When you run the `activiti.mssql.create.engine.sql` script, you might see the following warning in the log:

```
Warning! The maximum key length is 900 bytes. The index 'ACT_UNIQ_PROCDEF' has maximum
length of 1024 bytes. For some combination of large values, the insert/update operation will fail.
```

   It is very unlikely that the key length will be an issue in your deployment, and you can safely ignore this warning.

4. If you are going to direct audit logs to this repository, run the script that sets up the audit tables:

```
PS C:\Users\Administrator> sqlcmd -S localhost -d openidm ^
 -i C:\path\to\openidm\db\mssql\scripts\audit.sql
```

5. IDM requires an MS SQL driver that must be created from two separate JAR files. Create the driver as follows:

a. Download the JDBC Driver for SQL Server from Microsoft's download site. IDM requires at least version 4.2 of the driver (`sqljdbc_4.2.8112.100_enu.tar.gz`). The precise download URL might vary, depending on your location.

   Extract the JAR file (`sqljdbc42.jar`), using 7-zip or an equivalent file management application and copy the file to the `openidm\db\mssql\scripts` directory.

b. Download the `bnd` JAR file (bnd-2.4.0.jar) that enables you to create OSGi bundles. For more information about `bnd`, see http://bnd.bndtools.org/.

   Copy this JAR file to `openidm\db\mssql\scripts`.

c. Your `openidm\db\mssql\scripts` directory should now include the following files:

```
bnd-2.4.0.jar  sqljdbc4.bnd  sqljdbc42.jar
```

d. Create an OSGi bundle from the driver JAR with the following command:

```
C:\> cd \path\to\openidm\db\mssql\scripts
./> java -jar bnd-2.4.0.jar wrap --properties sqljdbc4.bnd --output sqljdbc42-osgi.jar sqljdbc42
.jar
```

   This step creates the OSGi bundle named `sqljdbc42-osgi.jar`.

e. Copy the `sqljdbc42-osgi.jar` file to the `openidm\bundle` directory:

```
./> copy sqljdbc42-osgi.jar \path\to\openidm\bundle
```

6. Remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

```
C:\> cd \path\to\openidm\my-project\conf\
.\> del repo.ds.json
```

7. Copy the database connection configuration file for MS SQL (`datasource.jdbc-default.json`) and the database table configuration file (`repo.jdbc.json`) to your project's configuration directory. For example:

```
C:\> cd \path\to\openidm
.\> copy db\mssql\conf\datasource.jdbc-default.json my-project\conf\
.\> copy db\mssql\conf\repo.jdbc.json my-project\conf\
```

8. Update the connection configuration to reflect your MS SQL deployment. The default connection configuration in the `datasource.jdbc-default.json` file is as follows:

```
{
    "driverClass" : "com.microsoft.sqlserver.jdbc.SQLServerDriver",
    "jdbcUrl" : "jdbc:sqlserver://
&{openidm.repo.host}:&{openidm.repo.port};instanceName=default;databaseName=openidm;applicationName=OpenIDM",
    "databaseName" : "openidm",
    "username" : "openidm",
    "password" : "openidm",
    "connectionTimeout" : 30000,
    "connectionPool" : {
        "type" : "hikari",
        "minimumIdle" : 20,
        "maximumPoolSize" : 50
    }
}
```

Specify the values for `openidm.repo.host` and `openidm.repo.port` in one of the following ways:

- Set the values in `resolver/boot.properties` or your project's `conf/system.properties` file, for example:

  ```
  openidm.repo.host = localhost
  openidm.repo.port = 1433
  ```

- Set the properties in the `OPENIDM_OPTS` environment variable and export that variable before startup. You must include the JVM memory options when you set this variable. For example:

  ```
  $ export OPENIDM_OPTS="-Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=1433"
  $ cd /path/to/openidm
  $ ./startup.sh -p my-project
  Executing ./startup.sh...
  Using OPENIDM_HOME:   /path/to/openidm
  Using PROJECT_HOME:   /path/to/openidm
  Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=1433
  Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
  Using boot properties at /path/to/openidm/resolver/boot
  .properties
  -> OpenIDM version "6.0.0.7"
  OpenIDM ready
  ```

When you have set up MySQL for use as the internal repository, start the server to check that the setup has been successful. After startup, you should see that `repo.jdbc` is `active`, whereas `repo.ds` is `enabled` but not `active`:

```
C:> cd \path\to\openidm
./> startup.bat -p my-project
"Using OPENIDM_HOME:   \path\to\openidm"
"Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dfile.encoding=UTF-8"
"Using LOGGING_CONFIG:
-Djava.util.logging.config.file=\path\to\openidm\conf\logging.properties"
 Using boot properties at \path\to\openidm\conf\boot\boot.properties
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
 [   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
 [   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
 [  10]   org.forgerock.openidm.datasource.jdbc  enabled
 [  10]   org.forgerock.openidm.repo.jdbc  enabled
    [  48] [active      ] org.forgerock.openidm.repo.jdbc
 [  11]   org.forgerock.openidm.repo.ds
 enabled
...
```

2.6. Setting Up an Oracle DB Repository

When you set up an Oracle database as the repository, confer with an Oracle DBA when creating the database schema, tables, and users. This section assumes that you have configured an Oracle DB with *Local Naming Parameters (tnsnames.ora)* and a service user for IDM.

1. Import the IDM schema using the data definition language script (`/path/to/openidm/db/oracle/scripts/openidm.sql`), as the appropriate schema owner user.

   When you have run the script, you should be able to query the `internaluser` table. The query should return two records (`openidm-admin` and `anonymous`). The output here has been formatted for legibility:

```
SQL> select * from internaluser;

OBJECTID     openidm-
admin
--------------------------------------------------------------------------------
REV          0
--------------------------------------------------------------------------------
PWD          openidm-
admin
--------------------------------------------------------------------------------
ROLES        [ { "_ref" : "repo/internal/role/openidm-admin" },
               { "_ref" : "repo/internal/role/openidm-
authorized" } ]
--------------------------------------------------------------------------------

OBJECTID     anonymous
--------------------------------------------------------------------------------
REV          0
--------------------------------------------------------------------------------
PWD          anonymous
--------------------------------------------------------------------------------
ROLES        [ { "_ref" : "repo/internal/role/openidm-
reg" } ]
--------------------------------------------------------------------------------
```

2. Run the three scripts that set up the tables required by the Activiti workflow engine.

   You can use the Oracle SQL Developer Data Modeler to run the scripts, as described in the corresponding Oracle documentation.

   You must run the following scripts:

   ```
   /path/to/openidm/db/oracle/scripts/activiti.oracle.create.engine.sql
   /path/to/openidm/db/oracle/scripts/activiti.oracle.create.history.sql
   /path/to/openidm/db/oracle/scripts/activiti.oracle.create.identity.sql
   ```

3. If you plan to direct audit logs to this repository, run the script that sets up the audit tables:

   You can use the Oracle SQL Developer Data Modeler to run the scripts, as described in the previous step.

   You must run the following script:

   ```
   /path/to/openidm/db/oracle/scripts/audit.sql
   ```

4. Create an Oracle DB driver from two separate jar files and set up the repository configuration for Oracle DB, as follows:

   a. Download the Oracle JDBC driver for your Oracle DB version from Oracle Technology Network and place it in the `openidm/db/oracle/scripts` directory:

      ```
      $ ls /path/to/openidm/db/oracle/scripts
      ojdbc7_g.jar    openidm.sql
      ```

   b. Create a `bnd` file and edit it to match the version information for your JDBC driver.

You can use the sample `bnd` file located in `openidm/db/mssql/scripts`. Copy the `bnd` file to the same location as the JDBC driver:

```
$ cd /path/to/openidm/db
$ cp mssql/scripts/sqljdbc4.bnd oracle/scripts
$ ls oracle/scripts
ojdbc7_g.jar    openidm.sql    sqljdbc4.bnd
```

The JDBC driver version information for your driver is located in the `Specification-Version` property in the MANIFEST file of the driver:

```
$ cd /path/to/openidm/db/oracle/scripts
$ unzip -q -c ojdbc7_g.jar META-INF/MANIFEST.MF
...
Specification-Vendor: Sun Microsystems Inc.
Specification-Title: JDBC
Specification-Version: 4
.0
...
```

Edit the `bnd` file to match the JDBC driver version:

```
$ more sqljdbc4.bnd
...
version=4.0
Export-Package: *;version=${version}
Bundle-Name: Oracle JDBC Driver 4.0 for SQL Server
Bundle-SymbolicName: Oracle JDBC Driver 4.0 for SQL Server
Bundle-Version: ${version}
Import-Package: *;resolution:=optional
```

c. Download the `bnd` JAR file (bnd-2.4.0.jar) that enables you to create OSGi bundles. For more information about `bnd`, see http://bnd.bndtools.org/.

Place the `bnd` JAR file in the same directory as the JDBC driver, and the `bnd` file:

```
$ ls /path/to/openidm/db/oracle/scripts
bnd-2.4.0.jar    ojdbc7_g.jar    openidm.sql    sqljdbc4.bnd
```

d. Change to the directory in which the script files are located and run the following command to create the OSGi bundle:

```
$ cd /path/to/openidm/db/oracle/scripts
$ java -jar bnd-2.4.0.jar wrap -properties sqljdbc4.bnd ojdbc7_g.jar
Dec 10, 2013 9:53:28 AM java.util.prefs.FileSystemPreferences$1 run
INFO: Created user preferences directory.
ojdbc7_g.jar 984 0
```

A new `.bar` file has now been created:

```
$ ls
bnd-2.4.0.jar  ojdbc7_g.bar  ojdbc7_g.jar  openidm.sql  sqljdbc4.bnd
```

e. Move the `.bar` file to the `openidm/bundle` directory and rename it with a `.jar` extension. It does not matter what you name the file:

```
$ mv ojdbc7_g.bar /path/to/openidm/bundle/ojdbc7_g-osgi.jar
```

5. Remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

```
$ cd /path/to/openidm/my-project/conf/
$ rm repo.ds.json
```

6. Copy the database connection configuration file for Oracle (`datasource.jdbc-default.json`) and the database table configuration file (`repo.jdbc.json`) to your project's configuration directory. For example:

```
$ cd /path/to/openidm/
$ cp db/oracle/conf/datasource.jdbc-default.json my-project/conf/
$ cp db/oracle/conf/repo.jdbc.json my-project/conf/
```

7. Update the connection configuration to reflect your Oracle database deployment. The default connection configuration in the `datasource.jdbc-default.json` file is as follows:

```
{
    "driverClass" : "oracle.jdbc.OracleDriver",
    "jdbcUrl" : "jdbc:oracle:thin:@//&{openidm.repo.host}:&{openidm.repo.port}/DEFAULTCATALOG",
    "databaseName" : "openidm",
    "username" : "openidm",
    "password" : "openidm",
    "connectionTimeout" : 30000,
    "connectionPool" : {
        "type" : "hikari",
        "minimumIdle" : 20,
        "maximumPoolSize" : 50
    }
}
```

Specify the values for `openidm.repo.host` and `openidm.repo.port` in one of the following ways:

- Set the values in `resolver/boot.properties` or your project's `conf/system.properties` file, for example:

```
openidm.repo.host = localhost
openidm.repo.port = 1525
```

- Set the properties in the `OPENIDM_OPTS` environment variable and export that variable before startup. You must include the JVM memory options when you set this variable. For example:

```
$ export OPENIDM_OPTS="-Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=1525"
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Executing ./startup.sh...
Using OPENIDM_HOME:   /path/to/openidm
Using PROJECT_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=1525
Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot
.properties
-> OpenIDM version "6.0.0.7"
OpenIDM ready
```

The `jdbcUrl` corresponds to the URL of the Oracle DB listener, including the service name, based on your configured Local Naming Parameters (tnsnames.ora). It should be whatever is appropriate for your environment.

The `DEFAULTCATALOG` refers to the SID (system identifier), for example, `orcl`.

The `username` and `password` correspond to the credentials of the service user that connects from IDM.

When you have set up an Oracle database for use as the internal repository, start the server to check that the setup has been successful. After startup, you should see that `repo.jdbc` is `active`, whereas `repo.ds` is `enabled` but not `active`:

```
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Using OPENIDM_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
Using LOGGING_CONFIG:
-Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot.properties
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
 [   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
 [   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
 [  10]   org.forgerock.openidm.datasource.jdbc  enabled
 [  10]   org.forgerock.openidm.repo.jdbc  enabled
    [  48] [active      ] org.forgerock.openidm.repo.jdbc
 [  11]   org.forgerock.openidm.repo.ds
 enabled
...
```

2.7. Setting Up a PostgreSQL Repository

This procedure assumes that PostgreSQL is installed and running on the local host. For supported versions, see "Supported Repositories" in the *Release Notes*.

Before starting IDM for the first time, configure the server to use a PostgreSQL repository, as described in the following procedure:

1. The `path/to/openidm/db/postgresql/scripts/createuser.pgsql` script sets up an `openidm` database and user, with a default password of `openidm`. The script also grants the appropriate permissions.

   Edit this script if you want to change the password of the `openidm` user, for example:

   ```
   $ more /path/to/openidm/db/postgresql/scripts/createuser.pgsql
   create user openidm with password 'mypassword';
   create database openidm encoding 'utf8' owner openidm;
   grant all privileges on database openidm to openidm;
   ```

2. Edit the Postgres client authentication configuration file, `pg_hba.conf`. Add the following entries for the following users: `postgres` and `openidm`:

   ```
   local   all   openidm      trust
   local   all   postgres      trust
   ```

3. As the `postgres` user, execute the `createuser.pgsql` script as follows:

   ```
   $ psql -U postgres < /path/to/openidm/db/postgresql/scripts/createuser.pgsql
   CREATE ROLE
   CREATE DATABASE
   GRANT
   ```

4. Execute the `openidm.pgsql` script as the new `openidm` user that you created in the first step:

   ```
   $ psql -U openidm < /path/to/openidm/db/postgresql/scripts/openidm.pgsql

   CREATE SCHEMA
   CREATE TABLE
   CREATE TABLE
   CREATE TABLE
   CREATE INDEX
   CREATE INDEX
   ...
   START TRANSACTION
   INSERT 0 1
   INSERT 0 1
   COMMIT
   CREATE INDEX
   CREATE INDEX
   ```

   Your database has now been initialized.

5. Run the three scripts that set up the tables required by the Activiti workflow engine:

   ```
   $ psql -d openidm -U openidm < /path/to/openidm/db/postgresql/scripts/activiti.postgres.create.engine
   .sql
   $ psql -d openidm -U openidm < /path/to/openidm/db/postgresql/scripts/activiti.postgres.create.history
   .sql
   $ psql -d openidm -U openidm < /path/to/openidm/db/postgresql/scripts/activiti.postgres.create
   .identity.sql
   ```

6. If you are going to direct audit logs to this repository, run the script that sets up the audit tables:

```
$ psql -d openidm -U openidm < /path/to/openidm/db/postgresql/scripts/audit.pgsql
```

7. Remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

```
$ cd /path/to/openidm/my-project/conf/
$ rm repo.ds.json
```

8. Copy the database connection configuration file for PostgreSQL (`datasource.jdbc-default.json`) and the database table file (`repo.jdbc.json`) to your project's configuration directory. For example:

```
$ cd /path/to/openidm
$ cp db/postgresql/conf/datasource.jdbc-default.json my-project/conf/
$ cp db/postgresql/conf/repo.jdbc.json my-project/conf/
```

9. Update the connection configuration to reflect your PostgreSQL deployment. The default connection configuration in the `datasource.jdbc-default.json` file is as follows:

```
{
    "driverClass" : "org.postgresql.Driver",
    "jdbcUrl" : "jdbc:postgresql://&{openidm.repo.host}:&{openidm.repo.port}/openidm",
    "databaseName" : "openidm",
    "username" : "openidm",
    "password" : "openidm",
    "connectionTimeout" : 30000,
    "connectionPool" : {
        "type" : "hikari",
        "minimumIdle" : 20,
        "maximumPoolSize" : 50
    }
}
```

   If you changed the password in step 1 of this procedure, edit the `datasource.jdbc-default.json` file to set the value for the `password` field to whatever password you set for the `openidm` user.

   Specify the values for `openidm.repo.host` and `openidm.repo.port` in one of the following ways:

   - Set the values in your `resolver/boot.properties` file:

     ```
     openidm.repo.host = localhost
     openidm.repo.port = 5432
     ```

   - Set the properties in the `OPENIDM_OPTS` environment variable and export that variable before startup. You must include the JVM memory options when you set this variable. For example:

```
$ export OPENIDM_OPTS="-Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=5432"
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Executing ./startup.sh...
Using OPENIDM_HOME:   /path/to/openidm
Using PROJECT_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=5432
Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot
.properties
-> OpenIDM version "6.0.0.7"
OpenIDM ready
```

10. PostgreSQL is now set up for use as the internal repository.

    Start IDM with the configuration for your project. Monitor the console for the success of your setup. After startup, run a `scr list` command. In the output, you should see that `repo.jdbc` is `active`, whereas `repo.ds` is `enabled` but not `active`:

```
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Using OPENIDM_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
Using LOGGING_CONFIG:
-Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot.properties
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
 [   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
 [   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
 [  10]   org.forgerock.openidm.datasource.jdbc  enabled
 [  10]   org.forgerock.openidm.repo.jdbc  enabled
    [  48] [active      ] org.forgerock.openidm.repo.jdbc
 [  11]   org.forgerock.openidm.repo.ds
 enabled
...
```

11. Set up indexes to tune the PostgreSQL repository according to your specific deployment.

    Important

    No indexes are set by default. If you do not tune the repository correctly by creating the required indexes, the performance of your service can be severely impacted. For example, setting too many indexes can have an adverse effect on performance during managed object creation. Conversely, not indexing fields that are searched will severely impact search performance.

    IDM includes a `/path/to/openidm/db/postgresql/scripts/default_schema_optimization.pgsql` script that sets up a number of indexes. This script includes extensive comments on the indexes that are being created. Review the script before you run it to ensure that all the indexes are suitable for your deployment.

When you have refined the script for your deployment, execute the script as a user with superuser privileges, so that the required extensions can be created. By default, this is the `postgres` user:

```
$ psql -U postgres openidm < /path/to/openidm/db/postgresql/scripts/default_schema_optimization.pgsql
CREATE INDEX
CREATE INDEX
CREATE INDEX
CREATE INDEX
CREATE INDEX
CREATE INDEX
```

2.8. Setting Up an IBM DB2 Repository

This section makes the following assumptions about the DB2 environment. If these assumptions do not match your DB2 environment, adapt the subsequent instructions accordingly.

- DB2 is running on the localhost, and is listening on the default port (50000).
- The user `db2inst1` is configured as the DB2 instance owner, and has the password `Passw0rd1`.

This section assumes that you will use basic username/password authentication. For instructions on configuring Kerberos authentication with a DB2 repository, see "Configuring Kerberos Authentication With a DB2 Repository".

Before you start, make sure that the server is stopped.

```
$ cd /path/to/openidm/
$ ./shutdown.sh
OpenIDM is not running, not stopping.
```

Configure IDM to use the DB2 repository, as described in the following steps:

1. Create an OSGi bundle for the DB2 JDBC driver, as follows:

   a. Download the DB2 JDBC driver for your database version from the IBM download site and place it in the `openidm/db/db2/scripts` directory.

      Use either the `db2jcc.jar` or `db2jcc4.jar`, depending on your DB2 version. For more information, see the DB2 JDBC Driver Versions.

      ```
      $ ls /path/to/db/db2/scripts/
      db2jcc.jar  openidm.sql
      ```

   b. Create a `bnd` file and edit it to match the version information for your JDBC driver.

      You can use the sample `bnd` file located in `openidm/db/mssql/scripts`. Copy the `bnd` file to the same location as the JDBC driver.

```
$ cd /path/to/openidm/db
$ cp mssql/scripts/sqljdbc4.bnd db2/scripts/
$ ls db2/scripts
db2jcc.jar  openidm.sql  sqljdbc4.bnd
```

The JDBC driver version information for your driver is located in the `Specification-Version` property in the MANIFEST file of the driver.

```
$ cd /path/to/openidm/db/db2/scripts
$ unzip -q -c db2jcc.jar META-INF/MANIFEST.MF
Manifest-Version: 1.0
Created-By: 1.4.2 (IBM Corporation)
```

Edit the `bnd` file to match the JDBC driver version.

```
$ more sqljdbc4.bnd
...
version=1.0
Export-Package: *;version=${version}
Bundle-Name: IBM JDBC DB2 Driver
Bundle-SymbolicName: com.ibm.db2.jcc.db2driver
Bundle-Version: ${version}
```

c. Download the `bnd` JAR file (bnd-2.4.0.jar) that enables you to create OSGi bundles. For more information about `bnd`, see http://bnd.bndtools.org/.

Place the `bnd` JAR file in the same directory as the JDBC driver, and the `bnd` file.

```
$ ls /path/to/openidm/db/db2/scripts
bnd-2.4.0.jar  db2jcc.jar  openidm.sql  sqljdbc4.bnd
```

d. Change to the directory in which the script files are located and run the following command to create the OSGi bundle:

```
$ cd /path/to/openidm/db/db2/scripts
```

```
$ java -jar bnd-2.4.0.jar wrap --properties sqljdbc4.bnd --output db2jcc-osgi.jar db2jcc.jar
```

This command creates an OSGi bundle, as defined by the `--output` option: `db2jcc-osgi.jar`:

```
$ ls
bnd-2.4.0.jar  db2jcc.bar  db2jcc.jar  openidm.sql  sqljdbc4.bnd
```

e. Move the OSGi bundle fle to the `openidm/bundle` directory:

```
$ mv db2jcc-osgi.jar /path/to/openidm/bundle/
```

2. Remove the default DS repository configuration file (`repo.ds.json`) from your project's `conf/` directory. For example:

```
$ cd /path/to/openidm/my-project/conf/
$ rm repo.ds.json
```

3. Copy the database connection configuration file for DB2 (`datasource.jdbc-default.json`) and the database table configuration file (`repo.jdbc.json`) to your project's configuration directory. For example:

```
$ cd /path/to/openidm/
$ cp db/db2/conf/datasource.jdbc-default.json my-project/conf/
$ cp db/db2/conf/repo.jdbc.json my-project/conf/
```

4. Update the connection configuration to reflect your DB2 deployment. The default connection configuration in the `datasource.jdbc-default.json` file is as follows:

```
{
    "driverClass" : "com.ibm.db2.jcc.DB2Driver",
    "jdbcUrl" : "jdbc:db2://&{openidm.repo.host}:&{openidm.repo.port}/
dopenidm:retrieveMessagesFromServerOnGetMessage=true;",
    "databaseName" : "sopenidm",
    "username" : "openidm",
    "password" : "openidm",
    "connectionTimeout" : 30000,
    "connectionPool" : {
        "type" : "hikari",
        "minimumIdle" : 20,
        "maximumPoolSize" : 50
    }
}
```

   Specify the values for `openidm.repo.host` and `openidm.repo.port` in one of the following ways:

   - Set the values in `resolver/boot.properties` or your project's `conf/system.properties` file, for example:

```
openidm.repo.host = localhost
openidm.repo.port = 50000
```

   - Set the properties in the `OPENIDM_OPTS` environment variable and export that variable before startup. You must include the JVM memory options when you set this variable. For example:

```
$ export OPENIDM_OPTS="-Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=50000"
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Executing ./startup.sh...
Using OPENIDM_HOME:   /path/to/openidm
Using PROJECT_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m -Dopenidm.repo.host=localhost -Dopenidm.repo.port=50000
Using LOGGING_CONFIG: -Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot
.properties
-> OpenIDM version "6.0.0.7"
OpenIDM ready
```

5. Create a user database for IDM (`dopenidm`).

```
$ db2 create database dopenidm
```

6. Import the IDM data definition language script into your DB2 instance.

```
$ cd /path/to/openidm
$ db2 -i -tf db/db2/scripts/openidm.sql
```

The database schema is defined in the `SOPENIDM` database.

7. You can show the list of tables in the repository, using the **db2 list** command, as follows:

```
$ db2 LIST TABLES for all

 Table/View                      Schema          Type  Creation
 time
------------------------------- --------------- ----- --------------------------
CLUSTEROBJECTPROPERTIES          SOPENIDM        T     2015-10-01-11.58.05.968933
CLUSTEROBJECTS                   SOPENIDM        T     2015-10-01-11.58.05.607075
CONFIGOBJECTPROPERTIES           SOPENIDM        T     2015-10-01-11.58.01.039999
CONFIGOBJECTS                    SOPENIDM        T     2015-10-01-11.58.00.570231
GENERICOBJECTPROPERTIES          SOPENIDM        T     2015-10-01-11.57.59.583530
GENERICOBJECTS                   SOPENIDM        T     2015-10-01-11.57.59.152221
INTERNALUSER                     SOPENIDM        T     2015-10-01-11.58.04.060990
LINKS                            SOPENIDM        T     2015-10-01-11.58.01.349194
MANAGEDOBJECTPROPERTIES          SOPENIDM        T     2015-10-01-11.58.00.261556
MANAGEDOBJECTS                   SOPENIDM        T     2015-10-01-11.57.59
.890152
...
```

8. Connect to the openidm database, then run the three scripts that set up the tables required by the Activiti workflow engine:

```
$ db2 connect to dopenidm
$ db2 -i -tf /path/to/openidm/db/db2/scripts/activiti.db2.create.engine.sql
$ db2 -i -tf /path/to/openidm/db/db2/scripts/activiti.db2.create.history.sql
$ db2 -i -tf /path/to/openidm/db/db2/scripts/activiti.db2.create.identity.sql
```

9. If you plan to direct audit logs to this repository, run the script that sets up the audit tables:

```
$ db2 -i -tf /path/to/openidm/db/db2/scripts/audit.sql
```

When you have set up DB2 for use as the internal repository, start the server to check that the setup has been successful. After startup, you should see that `repo.jdbc` is `active`, whereas `repo.ds` is `enabled` but not `active`:

```
$ cd /path/to/openidm
$ ./startup.sh -p my-project
Using OPENIDM_HOME:   /path/to/openidm
Using OPENIDM_OPTS:   -Xmx1024m -Xms1024m
Using LOGGING_CONFIG:
-Djava.util.logging.config.file=/path/to/openidm/conf/logging.properties
Using boot properties at /path/to/openidm/resolver/boot.properties
-> scr list
BundleId Component Name Default State
    Component Id State      PIDs (Factory PID)
 [   5]   org.forgerock.openidm.config.enhanced.starter  enabled
    [   1] [active      ] org.forgerock.openidm.config.enhanced.starter
 [   5]   org.forgerock.openidm.config.manage  enabled
    [   0] [active      ] org.forgerock.openidm.config.manage
 [  10]   org.forgerock.openidm.datasource.jdbc  enabled
 [  10]   org.forgerock.openidm.repo.jdbc  enabled
    [  48] [active      ] org.forgerock.openidm.repo.jdbc
 [  11]   org.forgerock.openidm.repo.ds
 enabled
...
```

2.8.1. Configuring Kerberos Authentication With a DB2 Repository

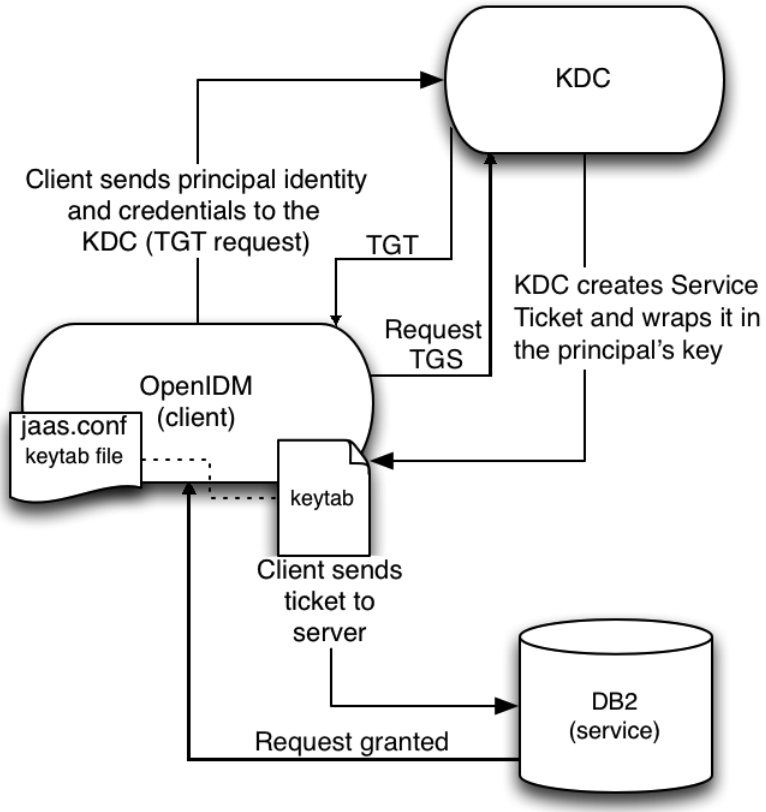
By default, IDM uses the username and password configured in the repository connection configuration file (`conf/datasource.jdbc-default.json`) to connect to the DB2 repository. You can configure IDM to use Kerberos authentication instead.

In this scenario, IDM acts as a *client* and requests a Kerberos ticket for a *service*, which is DB2, through the JDBC driver.

This section assumes that you have configured DB2 for Kerberos authentication. If that is not the case, follow the instructions in the corresponding DB2 documentation before you read this section.

The following diagram shows how the ticket is obtained and how the keytab is referenced from IDM's `jaas.conf` file.

Using Kerberos to Connect to a DB2 Repository



To configure IDM for Kerberos authentication:

1. Create a keytab file, specifically for use by IDM.

   A Kerberos keytab file (`krb5.keytab`) is an encrypted copy of the host's key. The keytab enables DB2 to validate the Kerberos ticket that it receives from IDM. You must create a keytab file on the host that IDM runs on. The keytab file must be secured in the same way that you would secure any password file. Specifically, only the user running IDM should have read and write access to this file.

   Create a keytab for DB2 authentication, in the file `openidm/security/idm.keytab/`:

   ```
   $ kadmin -p kadmin/admin -w password
   $ kadmin: ktadd -k /path/to/openidm/security/idm.keytab db2/idm.example.com
   ```

2. Make sure that the DB2 user has read access to the keytab.

3. Copy the DB2 Java Authentication and Authorization Service (JAAS) configuration file to the IDM `security` directory:

```
$ cd path/to/openidm
$ cp db/db2/conf/jaas.conf security/
```

   By default, IDM assumes that the keytab is in the file `openidm/security/idm.keytab` and that the principal identity is `db2/idm.example.com@EXAMPLE.COM`. Change the following lines in the `jaas.conf` file if you are using a different keytab:

```
keyTab="security/idm.keytab"
principal="db2/idm.example.com@EXAMPLE.COM"
```

4. Adjust the authentication details in your DB2 connection configuration file (`conf/datasource.jdbc-default.json`). Edit that file to remove `password` field and change the username to the instance owner (`db2`). The following excerpt shows the modified file:

```
{
    ...
    "databaseName" : "sopenidm",
    "username" : "db2",
    "connectionTimeout" : 30000,
    ...
}
```

5. Edit your project's `conf/system.properties` file, to add the required Java options for Kerberos authentication.

   In particular, add the following two lines to that file:

```
db2.jcc.securityMechanism=11
java.security.auth.login.config=security/jaas.conf
```

6. Restart IDM.

Chapter 3
Removing and Moving Server Software

This chapter covers uninstallation and describes how to move an existing installation to a different location.

To Remove IDM

1. (Optional) Stop the server if it is running, as described in "To Stop IDM".
2. Remove the file system directory where you installed the software:

```
$ rm -rf /path/to/openidm
```

3. (Optional) If you use a JDBC database for the repository, you can drop the `openidm` database.

To Move IDM

To move IDM to a different directory, you do not have to uninstall and reinstall the server. To move an existing instance, follow these steps:

1. Stop the server, as described in "To Stop IDM".
2. Remove the `felix-cache` directory:

```
$ cd path/to/openidm
$ rm -rf felix-cache
```

3. Move the files:

```
$ mv path/to/openidm path/to/new-openidm
```

4. Start the server in the new location:

```
$ cd path/to/new-openidm
$ ./startup.sh
```

Chapter 4
Updating Servers

This chapter describes how to update an existing deployment to the latest IDM release.

The update process is largely dependent on your deployment and on the extent to which you have customized IDM. Engage ForgeRock Support Services for help with updating an existing deployment.

4.1. Limitations of the Automated Update Process

You cannot use the automated update process in all deployments. This section lists the limitations:

Phased Update From Previous Versions

You cannot update directly from IDM 4, IDM 4.5, or IDM 5 to IDM 6.0.0.7. You must update to each major version successively, for example, from version 4 to 4.5, then from 4.5 to 5, 5 to 5.5, and then to this version.

- To update from IDM version 6.0.0.x to IDM 6.0.0.7, make note of the following point:

  Important

  The update from IDM 6.0.0.x to IDM 6.0.0.7 may require an extra upgrade step depending on the version you are updating from. For example, if you are on versions 6.0.0 to 6.0.0.4, you will need to download and apply a pre-patch file, then run the update. The pre-patch file ensures that the IDM version from which you are updating has the necessary files to successfully complete the update process.

  - If you are on IDM versions 6.0.0, 6.0.0.1, or 6.0.0.2: download `IDM-6.0.0.5-pre-patch-from-6.0.0-6.0.0.2.zip` from ForgeRock's BackStage site.
  - If you are on IDM versions 6.0.0.3 or 6.0.0.4: download `IDM-6.0.0.5-pre-patch-from-6.0.0.3-6.0.0.4.zip` from ForgeRock's BackStage site.
  - If you are on IDM 6.0.0.5 or higher, the update to version 6.0.0.7 does not require a pre-patch file.

  For more information, see "Applying the IDM 6.0.0.7 Patch Bundle Release".

- To update to version 6.0, follow the instructions shown in "Updating to Version 6.0".
- To update from version 5 to version 5.5, follow the instructions shown in *Updating To OpenIDM 5.5* in the *IDM 5.5 Installation Guide*.

- To update from version 4.5 to version 5, follow the instructions shown in *Updating To OpenIDM 5* in the *IDM 5 Installation Guide*.
- To update from version 4 to version 4.5, follow the instructions shown in *Updating From OpenIDM 4.0 to OpenIDM 4.5* in the *OpenIDM 4.5 Installation Guide*.

If you are updating from a version prior to version 4, you must follow the manual update process first:

- To migrate a deployment from 3.1 to 4, see *Migrating From OpenIDM 3.1 to OpenIDM 4.0* in the *OpenIDM 4 Installation Guide*.
- To migrate a deployment from 3 to 3.1, see *Migrating to OpenIDM 3.1* in the *OpenIDM 3.1 Installation Guide*.
- To migrate a deployment from 2.1 to 3, see *Migrating to OpenIDM 3* in the *OpenIDM 3 Installation Guide*.

Update on Windows Systems

Automated update is not supported on Microsoft Windows systems. If you are updating on that operating system, follow the manual update process:

- To migrate a Windows deployment from version 4 to version 4.5, see *Migrating From OpenIDM 4.0 to OpenIDM 4.5 on Windows* in the *OpenIDM 4.5 Installation Guide*.
- To migrate a Windows deployment from version 4.5 to 5, see *Migrating From OpenIDM 4.5 to OpenIDM 5 on Windows* in the *OpenIDM 5 Installation Guide*.
- To migrate a Windows deployment from version 5 to 5.5, see *Migrating From IDM 5 to IDM 5.5 on Windows* in the *OpenIDM 5.5 Installation Guide*.

Updating a Clustered Deployment

Updating nodes in a cluster is not presently supported. As a general practice, do not apply the update process to more than one node in a cluster. If you're updating a cluster, follow these steps:

- Redirect client traffic to a different IDM system or cluster.
- Shut down every node in the cluster.
- Update one node.
- Clone the first node to the other nodes in that cluster.

Supported Project Directories

The automated update process works for a project directory in the following locations:

- The default project directory, `/path/to/openidm`
- Outside of the IDM directory tree, such as `/home/project` or `/other/hard_drive/idm`

The update process does not support changes to any project directory when configured as a subdirectory of `/path/to/openidm`. That includes the samples listed in the `/path/to/openidm/samples` directory. For more information on the samples, see "*Overview of the Samples*" in the *Samples Guide*.

This documentation represents the project directory as *`project-dir`*.

As a best practice, copy the default project or sample to an external installation *`project-dir`* directory, such as `/path/to/project`. If needed, this is an opportunity to move the *`project-dir`* to such a location, to facilitate the update process.

Apart from the repository update scripts, the update process does not change information related to data and schema.

The update process also generally does not change scripts in your project directories. For a list of files affected during the update process, see "Files Changed During the Update Process".

Supported Repositories Only

Update is supported *only* with the JDBC repositories supported on IDM 5.5. As such, repository update scripts are provided only for those JDBC repositories.

Update is not supported for a ForgeRock Directory Services (DS) repository.

For instructions on installing a supported JDBC repository, see "*Selecting a Repository*".

Custom Configuration Files

If you customized configuration files for your IDM 5.5 deployment, such as JSON files, or files related to a custom UI, you'll need to reapply what you customized after the update is complete. For more information, see "Before Restarting IDM".

4.2. An Overview of the Update Process

This section provides background information on the update process. If you want to jump to the steps required to update to version 6.0, read "Updating to Version 6.0".

4.2.1. The Update Process in Labels

When you start an update, IDM goes through a process to determine the files to be updated, to facilitate repository updates, to move the server into maintenance mode before implementing an update, and then to restart after the update is complete. Most of these steps happen automatically

when you run the update from the UI or CLI. The following basic steps include labels that you might see in log files, if there are problems.

- `PREVIEW_ARCHIVE`: Preview the archive using appropriate checksums, to define the files to be updated.
- `ACCEPT_LICENSE`: Present the appropriate license for the update. If the license is not accepted, the update stops, and you retain all files in your current IDM installation.
- `LIST_REPO_UPDATES`: Identify and save scripts to update the current repository.
- `PAUSING_SCHEDULER`: Pause the scheduler, to prevent new jobs from starting during the update process.
- `WAIT_FOR_JOBS_TO_COMPLETE`: Wait for any currently running jobs to complete.
- `ENTER_MAINTENANCE_MODE`: Set the server in maintenance mode, which disables non-essential services.
- `INSTALL_ARCHIVE`: Install the update archive.
- `WAIT_FOR_INSTALL_DONE`: Wait until the installation of the update archive is complete.
- `MARK_REPO_UPDATES_COMPLETE`: Note status when repository updates are complete.
- `EXIT_MAINTENANCE_MODE`: Exit from maintenance mode.
- `ENABLE_SCHEDULER`: Enable the scheduler. Any schedules that were previously in place are re-established.

4.2.2. Files Changed During the Update Process

As of IDM 4, the server includes MD5 checksums for each file. These checksums allow the update process to verify file changes.

The update process compares the current checksum of every file with:

- The checksum of the file as originally installed.
- The checksum of any file included in the update or patch.

When you run the update process, changes are applied to the *`project-dir`*, either in the default directory, `/path/to/openidm`, or outside of the IDM directory tree, such as `/home/project`. If the *`project-dir`* is outside of the IDM directory tree, there is no MD5 checksum for that file. Based on that information, the update mechanism takes the following actions:

Files in `openidm/bundle`

Because of the nature of Java archives in the `openidm/bundle` directory, IDM updates all files in that directory, even if they have not changed.

New files are written to the target directory.

Existing files are saved with a .old-*unix_time* extension.

Files in `openidm/bin` and `openidm/ui/*/default`

New files are written to the target directory.

If the original file was customized, it is saved with a .old-*unix_time* extension.

Files in the `openidm/bin/defaults/script/ui` directory

For IDM 6.0, several files have been moved to the `openidm/bin/defaults/script` directory, including:

`mappingDetails.js`
`oauthProxy.js`
`onCreateUser.js`
`onDelete-user-cleanup.js`
`onUpdateUser.js`
`reconResults.js`

If you've called out any of these files in custom scripts, you'll need to update their locations. For example, the IDM update process updates the `onDelete` code block in the `managed.json` file to:

```
"onDelete" : {
    "type" : "text/javascript",
    "file" : "onDelete-user-cleanup.js"
},
```

Files in the `openidm/bin/defaults/script/info` directory

Files in this directory have been deleted, including:

`login.js`
`ping.js`
`uiconfig.js`
`version.js`

If you've called out any of these files in custom scripts, you'll need to find alternatives.

***project-dir*/script/access.js**

The update process overwrites the existing `access.js` file. If you've customized this file, such as for a custom endpoint, *back up* `access.js`. For more information on this file, see "Understanding the Access Configuration Script (`access.js`)" in the *Integrator's Guide*.

Files in the `project-dir/conf` directory, outside of the `/path/to/openidm` directory tree

Project configuration files (JSON): Files related to your project are patched with the content of the corresponding version 6.0 configuration file, regardless of whether they have been customized.

> **Warning**
>
> If you have customized standard IDM JSON configuration files, be careful. Analyze the corresponding version 6.0 file. It may include new features that you want. As a best practice, apply each customization

to the corresponding version 6.0 file and test the change before you put it into production. For more information, see "Before Restarting IDM".

System configuration files: (`system.properties`, `config.properties`, `logging.properties`, and `jetty.xml`) are written with a `.-new-unix_time` extension in the same directory, regardless of whether they have been customized. You *must* merge any changes from the latest version of the `.new` file into your existing configuration file. For more information, see "Before Restarting IDM".

Files in the default *`project-dir`*`/conf` directory, where *`project-dir`* is `/path/to/openidm`

Project configuration files (JSON): Files related to your project are overwritten with the content of the corresponding version 6.0 configuration file, regardless of whether they have been customized.

Warning

If you have customized any standard IDM JSON configuration files, be careful. Analyze the corresponding version 6.0 file. It may include new features that you want. As a best practice, apply and test each custom change to the version 6.0 configuration file. For more information, see "Before Restarting IDM".

System configuration files: (`system.properties`, `config.properties`, `logging.properties`, and `jetty.xml`) are not patched if they have been customized. Instead, the update process creates configuration files with a `.new-`*`unix_time`* extension in the same directory. You *must* merge any changes from these `.new-` files into your customized configuration files. For more information, see "Before Restarting IDM". If you have not customized these files, the update process replaces the existing configuration file with the corresponding version 6.0 file.

Files in any other directory

Existing files are overwritten and no backup files are created.

Configuration in the repository

Configuration information is stored in your repository. The update process overwrites information in that data store.

Note

The `unix_time` is the number of seconds since the `Unix Epoch` of January 1, 1970.

For a list of checksums, review the `openidm/.checksums.csv` file. It contains a list of checksums for every original file in your `openidm/` directory.

You need to copy update archives, in zip format, to the `openidm/bin/update` directory. IDM creates that directory during the start process.

Warning

If you've changed defaults in the `boot.properties` file, be careful, as this can affect the boot process. After update is complete, you'll find the 6.0.0.7 version of this file in your project's `resolver/` subdirectory. Pay

attention to changes to this file, especially the new `openidm.host` property as described in "Important Changes to Existing Functionality" in the *Release Notes*.

4.2.3. Files Added During the Update Process

Several new files are added to *`project-dir`*`/conf` during the update process

4.2.4. The `update.json` File

The `update.json` file, in the `/path/to/openidm` directory, specifies basic configuration parameters for the update process:

```
{
    "update" : {
        "description" : "Full product installation",
        "resource" : "https://backstage.forgerock.com/docs/idm/<current version number>/release-notes",
        "restartRequired" : true
    },
    "origin": {
        "product": "OpenIDM",
        "version": [
            "<current version number>"
        ]
    },
    "destination": {
        "product": "OpenIDM",
        "version": "<update version number>"
    },
    "removeFile" : [
        "<files to be removed>"
    ],
    "removeConfig" : [
        "<configurations to be removed>"
    ],
    "filesToBeIgnored" : [
        "security/keystore.jceks",
        "security/realm.properties",
        "security/truststore"
    ]
}
```

The version numbers may be either specific, such as `6.0`, `6.0.0.1`, `6.0.0.2`, `6.0.0.3`, or `6.0.0.4`. For a full explanation of how you can specify a range of versions, see "Setting the Connector Reference Properties" in the *Integrator's Guide*.

If you want to delete files during the update process, include them in the `removeFile` code block. You can include files in the following formats:

- Individual files.
- Directories: If you specify a directory, the update process will remove that directory, all files within that directory, and all subdirectories, recursively.

- Files and directories with wildcards: If you specify a UNIX-style wildcard, `*` or `?`, the update process will remove all files that meet the requirements of the wildcard.

To remove configurations during the update, include the corresponding `.json` files in the `removeConfig` array. Do not include the path to these files. During the update, IDM recognizes these as configuration files and attempts to remove the corresponding configuration from the repository.

Note

To preserve existing keystore and truststore files, `update.json` includes the default versions of these files in the `filesToBeIgnored` code block.

If you want to keep the update process from overwriting other files, add them to the same code block.

4.2.4.1. Setting up a Custom Update

You can create your own custom update binary. To do so, you'll need to modify two files:

- `.checksum.csv`

  Add an MD5 checksum for each file in your binary to a new `.checksum.csv` file. For guidance, see the same hidden file in the `/path/to/openidm` directory.

- `update.json`

  If you want to try your own update, make sure that the `origin` and `destination` version numbers match your current and planned update versions of IDM. For more information, see "The `update.json` File".

Warning

If you use the IDM update process with your own update binary, this may affect your ability to update IDM to 6.0 and beyond.

4.2.5. Command-Line Update Options

On UNIX/Linux systems, you can update to IDM 6.0 by using the **cli.sh update** command. For general information on **cli.sh** and **cli.bat**, see "*Command-Line Interface*" in the *Integrator's Guide*.

The following command updates the local system with the IDM-6.0.0.zip binary:

```
$ cd /path/to/openidm
$ ./cli.sh update
 \
--acceptLicense
 \
--user openidm-admin:openidm-admin
 \
--url http://localhost:8080/openidm \
IDM-6.0.0.zip
```

The `update` subcommand takes the following options:

`-u` or `--user` USER[:PASSWORD]

Allows you to specify the server user and password. Specifying a username is mandatory. If you do not specify a username, the following error is shown in the OSGi console: `Remote operation failed: Unauthorized`. If you do not specify a password, you are prompted for one. This option is used by all three subcommands.

`--url` URL

The URL of the REST service. The default URL is `http://localhost:8080/openidm/`.

`-P` or `--port` PORT

The port number associated with the REST service. If specified, this option overrides any port number specified with the **--url** option. The default port is 8080.

`--acceptLicense`

Automatically accept the license shown in `/path/to/openidm/legal-notices/Forgerock_License.txt`. If you omit this option, the update process prompts you to accept or decline the license.

`--skipRepoUpdatePreview`

Bypasses a preview of repository updates. Suitable if you have already downloaded and approved changes to your repository.

`--maxJobsFinishWaitTimeMs` TIME

The maximum time, in milliseconds, that the command should wait for scheduled jobs to finish before proceeding with the update.

Default: `-1`, (the process exits immediately if any jobs are running)

`--maxUpdateWaitTimeMs` TIME

The maximum time, in milliseconds, that the server should wait for the update process to complete.

Default: `30000` ms

`-l` or `--log` LOG_FILE

Path to the log file.

Default: `logs/update.log`

`-Q` or `--quiet`

Use quiet mode to minimize messages at the console; messages are still available in the log file defined by `--log`.

Note

If you use `--quiet` mode for updates, include the `--acceptLicense` option.

If you do not run the command in quiet mode, messages similar to the following are displayed in the console window where you launched the command:

```
Executing ./cli.sh...
Starting shell in /path/to/openidm
Using boot properties at /path/to/openidm/resolver/boot.properties
License was accepted via command line argument.
Pausing the Scheduler
Scheduler has been paused.
Waiting for running jobs to finish.
All running jobs have finished.
Entering into maintenance mode...
Now in maintenance mode.
Installing the update archive IDM-6.0.0.zip
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
The update process is complete with a status of COMPLETE
Restarting OpenIDM.
Restart request completed.
```

4.2.6. Update File States

During the update process, you may see status information for each file, during three stages of an update:

- "Preview of File Updates"
- "Update Status Message"
- "Updated Files: What Happened"

Preview of File Updates

Status	Description
UNEXPECTED	Existing file is not in the list of known files for the original distribution.
NONEXISTENT	A file in the new installation that does not exist in the original distribution. This is always the status for *versioned* files, such as the `openidm-*.jar` files in the `openidm/bundle/` directory.
DELETED	The file should exist in the current installation but does not; the file is installed during the update.
DIFFERS	The file, located in a read-only directory, has changed, since the original deployment.
UNCHANGED	The file is not changed from the original distribution.

Update Status Message

Status	Description
IN_PROGRESS	Update has started, not yet complete
PENDING_REPO_UPDATES	The update is complete; however, repository updates are pending
COMPLETE	Update is complete
FAILED	Update failed

Updated Files: What Happened

Status	Description
REPLACED	Original file replaced; if the original file was changed by a user, it is saved with a `.old` extension.
PRESERVED	Original file saved with changes made by a user. New file saved with a `.new` extension.
APPLIED	The update changed the file.
REMOVED	The update removed the file.
FAILED	The attempt to update the file, via a patch, did not work.

4.3. Updating to Version 6.0

If you are on a version prior to IDM 6.0, for example IDM 5.5, then you must first update to version 6.0.

In the following sections, you'll:

- "Prepare Your Update".
- "Update to IDM 6.0".
- "Before Restarting IDM".

4.3.1. Prepare Your Update

You *must* take the following steps before you start an automated update:

1. Update your Java environment.

   IDM 6.0 requires a supported Java environment, as described in "Preparing the Java Environment" in the *Release Notes*.

If your server uses an older version, install a newer Java version before you update and follow the instructions in "Java Prerequisites".

2. Download the new software.

   Download `IDM-6.0.0.zip` from ForgeRock's BackStage site, and copy it to the `/path/to/openidm/bin/update` directory.

   Note

   IDM creates the `/path/to/openidm/bin/update` directory the first time you start IDM.

3. Back up your deployment.

   a. Before you start the update process, back up your existing deployment by archiving the `openidm` directory and the contents of your repository. Because there is no "undo" option available during the update process, you can use this backup to restore your deployment or restart the update process if something goes wrong.

   b. Save any customized `*.json` configuration files, typically located in your project's `conf/` subdirectory. You'll need to make judgements on how to apply these customizations to your version 6.0 deployment after the update is complete.

   c. Identify files in custom directories. Save them, and apply them to your updated deployment after all stages of the update process are complete. For more information, see "Before Restarting IDM".

   d. If you have encrypted or obfuscated any properties in configuration files, decrypt them into their plain text values before you start the update. When the update process is complete, you can encrypt or obfuscate the values again.

   e. Save your audit data. If you want to preserve a record of the audit logs collected while IDM 5.5 was running, you will need to save these log files manually before you start the update process. You can find the log files in the `/path/to/openidm/audit/` directory. For more information on these files, see "Audit Event Topics" in the *Integrator's Guide*.

      Tip

      File rotation tip: When you delete files in the `/path/to/openidm/audit/` directory, IDM creates new files as needed in the same directory.

4. Change read-only deployments.

   If your project directory is located on a read-only volume, mount that directory in read-write mode before you start the update process.

5. Disable authentication modules used with AM.

   If you have integrated IDM with AM, first disable the authentication module you used. You can re-enable this module when the update is complete.

   If you set up the connection as described in "*Integrating IDM With the ForgeRock Identity Platform*" in the *Samples Guide*, follow these steps to disable the connection to AM:

   a. • In the Admin UI, select Configure > Authentication. If you've configured the connection with AM, the authentication provider should be set to the `ForgeRock Identity Provider`. Change it to `Local`.

      • Alternatively, edit the `authentication.json` file for your project. Delete the code block with your selected authentication module. Depending on your version of IDM and deployment, the module may be named `OAUTH_CLIENT`, `OPENID_CONNECT`, or `OPENAM_SESSION`.

   b. From the UI, navigate to the URL for IDM. You should now be able to log into IDM normally, without authenticating through AM.

   If you need integration with AM, you should also upgrade to AM 6.0. For more information, see the *AM Upgrade Guide*.

   When the update process is complete, you can re-enable the connection to AM. To do so, follow the steps described in "*Integrating IDM With the ForgeRock Identity Platform*" in the *Samples Guide*.

6. Review repository update scripts.

   IDM 6.0 includes a number of scripts that you must run to update your repository schema. The update process detects which scripts are required for your particular repository, extracts them from the IDM 6.0 binary, and prompts you to save them in the directory that you specify.

   The scripts vary by database. For a list of all the repository update scripts, see "Repository Update Scripts". The path you specify is relative to the `/path/to/openidm/` directory.

   Important

   If you are using a managed relational database service such as Amazon RDS, be aware that some update scripts might require root level access to the system tables in the underlying database.

   Specifically, certain PostgreSQL update scripts require access to the `pg_attribute` table. Because the database service master user is not the same as the PostgreSQL root user, such scripts might fail with a permissions error. In this case, investigate the failing script, and use an `ALTER TABLE` command on the specific IDM table instead.

   Before you run the repository update scripts, review the scripts that correspond to your repository with your Database Administrator (DBA).

7. Start the server.

IDM must be running when you launch an update using the CLI.

Warning

If you use custom versions of IDM Admin and Self-Service UIs, the update process may affect you in different ways; for more information, see "Files Changed During the Update Process". If you followed the procedure described in "Customizing the Admin UI" in the *Integrator's Guide*, you'll have custom files in the `openidm/ui/admin/extension` and `openidm/ui/selfservice/extension` directories.

IDM 6.0 includes significant UI improvements. The update process does not copy those improvements to the noted `extension/` subdirectories.

When you're ready to run the update process, see "Update to IDM 6.0".

4.3.1.1. Repository Update Scripts

The scripts required for an update from IDM 5.5 to IDM 6.0 are available in the `openidm/db/repo/scripts/updates` directory. The following table lists the scripts that must be run for each corresponding database.

Repository Schema Update Scripts

Databases	Scripts

DB2, MSSQL, MySQL	`v11_drop_security_keys_table.sql`
	`v12_hybridize_relationships_table.sql`
	`v13_increase_audit_authentication_method_size.sql`*
	`v14_insert_openidm_prometheus_into_internalroles_table.sql`

Oracle, PostgreSQL	`v14_drop_security_keys_table.sql`
	`v15_hybridize_relationships_table.sql`
	`v16_increase_audit_authentication_method_size.sql`*
	`v17_insert_openidm_prometheus_into_internalroles_table.sql`

Update Notes for Database Administrators (DBAs)

Make sure you have a qualified DBA review these scripts.

- For a DB2 repository, review the `v12_hybridize_relationships_table.sql` script with a DBA. Change `MAX_RELATION_SHIP_ID_COLUMN` to an integer that is 1 more than the current maximum of the relationship ID column before you run this update script.
- For a PostgreSQL repository, you must run the `v16_increase_audit_authentication_method_size.sql` with Superuser privileges to access the `pg_attribute`. For example:

```
$ psql -U postgres openidm < /path/to/v16_increase_audit_authentication_method_size.sql
```

- The following script, `v*_increase_audit_authentication_method_size.sql` , assumes you've redirected audit logs to the IDM external repository. If you've redirected audit logs elsewhere, make sure your DBA applies the equivalent commands to that repository.

If you apply that script without redirecting audit logs to the IDM external repository, you may see the following message:

```
ERROR 1146 (42S02) at line 1: Table 'openidm.auditauthentication' doesn't exist
```

If you've redirected audit logs elsewhere, or choose to retain them in the `/path/to/openidm/audit` directory, you can safely ignore this error.

4.3.2. Update to IDM 6.0

When you have completed the steps in "Prepare Your Update", your instance of IDM is ready for an update to version 6.0.

During the update process to IDM 6.0, you may see around 1000 lines of errors in the console. These errors do not affect the update process, and will disappear after you shut down and restart IDM.

Now start the update process, using the CLI or the Admin UI. This section includes separate procedures for those options.

Note

For IDM 6.0, automatic restart has been removed from the update process. You'll have to:

- Shut down IDM after the automated part of the update process is complete.
- You must not restart IDM until meeting the requirements described in "Before Restarting IDM".

Updating From the CLI

1. Start the update process from the command-line, with the following binary, IDM-6.0.0.zip:

```
$ cd /path/to/openidm
$ ./cli.sh update
 \
--acceptLicense
 \
--user openidm-admin:openidm-admin
 \
--url http://localhost:8080/openidm \
IDM-6.0.0.zip
```

Note

If you are using a port other than `8080`, specify the port number. Include **--port *number*** in the **./cli.sh update** command.

2. During the update process, you are prompted to save applicable repository update scripts. For a full list, see "Repository Update Scripts". You might see a message similar to the following:

```
Database repo update files present in archive were found:
vmm_something.sql
vnn_another_update.sql
Please enter the directory to save repository update files:
```

Enter a directory name, such as `update-scripts`. The update process creates this directory, relative to your IDM installation directory, and saves the required scripts to that directory.

The update then displays the following message:

```
Repository scripts are in the following directory: update-scripts.
Please apply the update scripts now. When complete, run the update again with the
--skipRepoUpdatePreview option.
```

3. Before applying database repository scripts, review "Repository Update Scripts", especially the following note: Update Notes for Database Administrators (DBAs) for potential pitfalls.

   Apply the database repository scripts in numeric order. How you apply these scripts depends on your repository. The following example applies a hypothetical update script required for a MySQL repository:

   ```
   $ mysql -u root -p < openidm/update-scripts/v999_something_added.sql
   ```

4. After you've run the database repository scripts, run the same **cli.sh update** command again; add the following option: **--skipRepoUpdatePreview**:

   ```
   $ cd /path/to/openidm
   $ ./cli.sh update
    \
   --acceptLicense
    \
   --skipRepoUpdatePreview
    \
   --user openidm-admin:openidm-admin
    \
   --url http://localhost:8080/openidm \
   IDM-6.0.0.zip
   ```

   The update continues. The process may take a few minutes. When the update is complete, you'll see the following messages:

   ```
   The update process is complete.
   Exiting maintenance mode...
   No longer in maintenance mode.
   Resuming the job scheduler.
   Scheduler has been resumed.
   ```

5. After update, check if you have multiple versions of the `bundle/openidm-repo-opendj-<version>` files, for example, `bundle/openidm-repo-opendj-6.0.0.jar` or `bundle/openidm-repo-opendj-6.0.0.x.jar`. Manually remove the oldest version, which should be the file generated from the release before the 6.0.0.4 update.

6. Run the following Groovy script to clear the `reconprogressstate` data in your repository:

```
def result = openidm.query(
      "repo/reconprogressstate", [ "_queryFilter" : "true", "_fields" : "_id" ]).result;
      for ( item in result ) {
      openidm.delete("repo/reconprogressstate/" + item["_id"], null);
      }
      return result.size() + " reconprogressstate records deleted";
```

This script will work regardless of the type of repository, and can be sent as a REST call. For example:

```
curl \
      --header "X-OpenIDM-Username: openidm-admin" \
      --header "X-OpenIDM-Password: openidm-admin" \
      --header "Content-Type: application/json" \
      --request POST \
      --data '{
      "type":"groovy",
      "source":"def result = openidm.query(\"repo/reconprogressstate\", [ \"_queryFilter\" : \"true\",
 \"_fields\" : \"_id\" ]).result; for ( item in result ) { openidm.delete(\"repo/reconprogressstate/\"
 + item[\"_id\"], null); }; return result.size() + \" reconprogressstate records deleted\";"
      }' \
      "http://localhost:8080/openidm/script?_action=eval"
      "1 reconprogressstate records deleted"
```

7. IDM does not restart automatically. To continue the update process, you must shut down IDM:

```
-> shutdown
```

8. Continue the update process in the following section: "Before Restarting IDM".

Updating From the Admin UI

1. Log into the Admin UI at `http://localhost:8080/admin`.

2. Select Configure > System Preferences, and choose the Update tab. You should see `IDM-6.0.0.zip` in the list of Available Updates.

3. Next to `IDM-6.0.0.zip`, select Install to start the initial update process, then Confirm and Install to enable Maintenance Mode.

4. The instructions in the UI are intuitive.

   During the update, an Installation Preview screen will show you a list of the files that will be affected by the update, in the categories described in "Preview of File Updates". You'll be asked to confirm the Update and accept the license agreement.

5. The Repository Update Script Preview shows the scripts that you must run to update your repository.

   Download all of the scripts and move them to a local directory (for example `openidm/update-scripts`). Then, *before* you select Continue, open a command line interface and apply the specified scripts, which vary by repository (as shown in "Repository Update Scripts".

How you apply these scripts will depend on your repository. The following example applies a hypothetical update script required for a MySQL repository:

```
$ mysql -u root -p < openidm/update-scripts/v999_something_added.sql
```

When you have applied all update scripts shown, select Continue.

6. The update starts again and processes needed files.
7. When you have applied the scripts, click Mark Complete to continue the update process.
8. When the update is complete, close the browser.
9. IDM does not restart automatically. To continue the update process, go to the IDM console and run the following command:

```
-> shutdown
```

10. You'll have to shutdown and restart IDM from the command line, modify configuration files, and more, as discussed in "Before Restarting IDM".

4.3.3. Before Restarting IDM

Read this section after the automated part of the updated process is complete and before restarting IDM.

The IDM update process makes significant changes to a variety of files, as described in the following sections:

- "IDM Labels by Date"
- "What You Should Do With Your Properties Files Before Restarting"
- "What You Should Do With Your JSON Files Before Restarting"
- "Special Update Situation: `authentication.json`"
- "Special Update Situation: `_meta` Data and `managed.json`"
- "Special Update Situation: `notify*` Tags in `managed.json`"
- "What You Should Do With Your UI Before Restarting"
- "Restarting IDM After Managing Custom Changes"

You can then proceed with "Restarting IDM After Managing Custom Changes".

4.3.3.1. IDM Labels by Date

If you customized your existing deployment, you may find files with the following extensions: `.old` and `.new`. For more information, see "An Overview of the Update Process".

On Linux/UNIX systems, you can find *some* of these files with the following commands:

```
$ cd /path/to/openidm
$ find . -type f -name "*.old*"
$ find . -type f -name "*.new*"
```

- Files with the `.old-unix_time` extension are saved from the configuration you had when starting this update process.
- Files with the `.new-unix_time` extension are files from IDM 6.0 that have not been incorporated into your updated installation. For example, if you find a `system.properties.new-unix_time` file in your `project-dir` directory, IDM is still using your pre-update version of this file, which would still be named `system.properties`.

  To take full advantage of IDM 6.0, analyze the new features shown in files with the `.new-unix_time` extension. If you have files with multiple `.new-unix_time` extensions, use the file with the latest *unix_time*.

4.3.3.2. What You Should Do With Your Properties Files Before Restarting

As suggested in "IDM Labels by Date", if you have a custom version of a `.properties` file in your deployment, you'll see the new version of properties files in your project directory.

For example, if you set up a custom `system.properties` file, you should should see two versions of this file:

```
$ cd /path/to/project
$ ls
system.properties system.properties.new-<unix_time>
```

In general, the file with the `.new-<unix_time>` extension corresponds to IDM 6.0 version.

There is one exception: `boot.properties`. After the update process is complete, you'll find different versions of this file in two locations:

- In your project's `conf/boot/` subdirectory, which should contain the version of the file that you used for IDM 5.5.
- In the `/path/to/openidm/resolver/` directory. This is the new location for `boot.properties`, starting with IDM 6.0.0.7.

Before restarting IDM, you must update all such `.properties` files.

Make sure your custom settings are shown in the IDM 6.0 version of each file.

Note

If you did not customize these `.properties` files, the IDM update process will overwrite the `config.properties`, `logging.properties`, and `system.properties` files.

4.3.3.2.1. Updating `logging.properties`

Recent security fixes prevent Jetty from logging sensitive data, such as passwords. Verify that your `conf/logging.properties` file includes the following excerpt (and add the excerpt if necessary) to prevent unnecessary data from being logged:

```
# Logs the output from Jetty
  # Sets the following Jetty classes to INFO level by default because if logging is set to FINE or higher,
  # sensitive information can be leaked into the logs
  org.eclipse.jetty.server.HttpChannel.level=INFO
  org.eclipse.jetty.server.HttpConnection.level=INFO
  org.eclipse.jetty.server.HttpInput.level=INFO
  org.eclipse.jetty.http.HttpParser.level=INFO
  org.eclipse.jetty.io.ssl.SslConnection.level=INFO
```

This configuration logs request data at `INFO` level, preventing data such as password changes from being logged. In situations where you *need* to log all data (for example, if you are debugging an issue in a test environment) change the settings here to `FINE` or `FINEST`. For example:

```
org.eclipse.jetty.server.HttpConnection.level=FINE
```

4.3.3.3. What You Should Do With Your JSON Files Before Restarting

The update process does not account for any changes that you made to existing standard JSON files such as `sync.json` and `managed.json`. In fact, the update process overwrites these files with the standard IDM 6.0 versions of those files.

Do not overwrite the new version 6.0 files. Instead, analyze the custom settings from your original JSON files. Review "*What's New*" in the *Release Notes*. Apply each custom setting to the files in your updated deployment and test the results to make sure they still work as intended.

If you've called out UI-related scripts in JSON files, be aware that some of them have been either moved or deleted. For a list, see "Files Changed During the Update Process".

Note

If you've followed the recommendations in "Configuring the Server for Production" in the *Integrator's Guide*, changes you've written directly to JSON files may not be loaded into the repository. This includes JSON files that may have been removed per the `removeFile` code block in "The `update.json` File".

To address these issues, you have two options:

- Write changes directly to the repository, using an HTTP PATCH request.

- Temporarily change production settings that may block configuration updates from JSON files, such as those described in "Disabling Automatic Configuration Updates" in the *Integrator's Guide*.

Pay particular attention to your connector configuration files (`provisioner.openicf-connector-name.json`). The update removes outdated connector versions so you *must* make sure that the `bundleVersion` in your connector configuration matches the version of the connector in `/path/to/openidm/connectors`, or specifies a range that includes the connector version, for example `[1.1.0.0,1.4.0.0]`. For more information, see "Setting the Connector Reference Properties" in the *Integrator's Guide*.

4.3.3.4. Special Update Situation: `authentication.json`

The IDM update process does not include changes to the `authentication.json` file. Before restarting IDM, you'll have to change that file manually.

Based on the default configurations of IDM 6.0 and IDM 5.5, make the following changes to your `authentication.json` file:

`CLIENT_CERT` authentication module

The `queryOnResource` entry has been changed from `security/truststore` to `managed/user`. For more information, see "Configuring Client Certificate Authentication" in the *Integrator's Guide*.

Second `STATIC_USER` authentication module

IDM 6.0 includes a second `STATIC_USER` authentication module for the Prometheus user for monitoring metrics, as described in "Metrics and Monitoring" in the *Integrator's Guide*:

```
{
    "name" : "STATIC_USER",
    "properties" : {
        "queryOnResource" : "repo/internal/user",
        "username" : "&{openidm.prometheus.username}",
        "password" : "&{openidm.prometheus.password}",
        "defaultUserRoles" : [
            "openidm-prometheus"
        ]
    },
    "enabled" : true
}
```

4.3.3.5. Special Update Situation: `_meta` Data and `managed.json`

The IDM update process does not include `_meta`-related changes to the `managed.json` file. If you're updating IDM and want to take advantage of Progressive Profile Completion, Terms & Conditions, or Privacy & Consent as described in "*Configuring User Self-Service*" in the *Integrator's Guide*, you'll need to add `_meta` to this file.

If you want to collect `_meta` data on your users, and based on the default configurations of IDM 6.0 and IDM 5.5, you'll have to update `managed.json` manually. Add the following code block to the end of the `user` object in `managed.json`:

```
"meta" : {
  "property" : "_meta",
  "resourceCollection" : "internal/usermeta",
  "trackedProperties" : [
      "createDate",
      "lastChanged"
  ]
}
```

After completing your configuration updates and restarting IDM, the `repairMetadata` script will need to be run to complete generating the new user metadata. For more information, see "Generating Metadata For Existing Users" in the *Integrator's Guide*.

4.3.3.6. Special Update Situation: `notify*` Tags in `managed.json`

The IDM update process does not include `notify` and `notifySelf` tags for social identity providers in the `managed.json` file. You'll need to include those tags to take advantage of performance improvements for IDM 6.0. For more information on the `notifySelf` tag, see "Configuring Relationship Change Notification" in the *Integrator's Guide*.

Include the `"notifySelf" : true,` line, as shown at the bottom of the following excerpt:

```
...
"idps" : {
    "title" : "Identity Providers",
    "viewable" : true,
    "searchable" : false,
    "userEditable" : false,
    "returnByDefault" : false,
    "type" : "array",
    "items" : {
        "type" : "relationship",
        "reverseRelationship" : true,
        "reversePropertyName" : "user",
        "notifySelf" : true,
...
```

Include the `"notify" : true,` line in the `resourceCollection` code block for each social identity provider:

```
"resourceCollection" : [
    {
        "path" : "managed/user",
        "notify" : true,
        "label" : "User",
        "query" : {
            "queryFilter" : "true",
            "fields" : [
                "userName"
            ],
            "sortKeys" : [
                "userName"
            ]
        }
    }
]
```

4.3.3.7. What You Should Do With Your UI Before Restarting

If you have a custom Admin or Self-Service UI, you need to take a few extra steps.

You will need the updated UI files from the `openidm/ui/admin/default` and `openidm/ui/selfservice/default` directories.

Warning

Make sure you've saved any custom files from the `openidm/ui/admin/extension` and `openidm/ui/selfservice/extension` subdirectories, as described in the introduction to "Updating to Version 6.0", and then follow these steps:

1. Delete the existing `openidm/ui/admin/extension` and `openidm/ui/selfservice/extension` subdirectories.
2. Copy files from the `openidm/ui/admin/default` and `openidm/ui/selfservice/default` subdirectories with the following commands:

   ```
   $ cd /path/to/openidm/ui
   $ cp -r selfservice/default/. selfservice/extension
   $ cp -r admin/default/. admin/extension
   ```

3. Review your UI custom files. Compare them against the IDM 6.0 version of these files.
4. Apply your custom changes to each new IDM 6.0 UI file in the `openidm/ui/admin/extension` and `openidm/ui/selfservice/extension` subdirectories.

4.3.3.8. Restarting IDM After Managing Custom Changes

Now that you've updated the configuration of IDM, you can restart it, for the first time with IDM 6.0 software. When you do so, you should see the following message in the OSGi console:

```
-> OpenIDM version "6.0" (revision: <someUUIDsubset>)
jenkins-openidm-pipeline-openidm-master-postcommit-<num> master
OpenIDM ready
```

When you've restarted IDM, you'll need to modify repository relationships, as described in the following section:

4.3.3.8.1. Migrating Repository Relationships

Repository relationships have changed for IDM 6.0, as they separate the managed object container and ID `firstId` and `secondId` into distinct identifiers for resource containers and IDs.

To update your repository, use the following REST call:

```
$ curl \
--header "X-OpenIDM-Username: openidm-admin"
 \
--header "X-OpenIDM-Password: openidm-admin"
 \
--header "Content-Type: application/json"
 \
--request POST
 \
--data '{
"type":"text/javascript",
"file":"bin/defaults/script/update/migrateRepoRelationshipsData.js"
}' \
"http://localhost:8080/openidm/script/?_action=eval"
```

You can find this script, `migrateRepoRelationshipsData.js`, after update is complete, in the following directory: `/path/to/openidm/bin/defaults/script/update`

4.3.4. Migrating to IDM 6.0 on Windows

The steps outlined in this section will help you take advantage of the new functionality offered in this version, while preserving your custom configuration where possible. Before you start, read through "*Compatibility*" in the *Release Notes*. Some of these changes might affect your existing deployment.

Note

Updates to IDM 6.0 on Microsoft Windows remain a manual process.

To perform a migration from IDM 5.5 to IDM 6.0 on Windows, follow these steps. For the purposes of this procedure, the path to the existing instance of IDM 5.5 is defined as `\path\to\openidm-5.5`. In contrast, the path to the IDM 6.0 deployment is defined as `\path\to\openidm-6.0`:

1. Download and extract IDM 6.0 (`IDM-6.0.0.zip`).
2. Stop your existing IDM 5.5 server, if it is running. Access the Java console where it is running and enter the **shutdown** command at the OSGi console:

```
-> OpenIDM ready
-> shutdown
```

3. Backup: Save your current deployment. Archive the `openidm` directory.

4. Boot properties: On the IDM 6.0 server, edit the `resolver\boot.properties` file to match any customizations that you made on your IDM 5.5 server. Specifically, check the following elements:

   - The HTTP, HTTPS, and mutual authentication ports are specified in the `revolver\boot.properties` file. If you changed the default ports in your IDM 5.5 deployment, make sure that the corresponding ports are specified in this file.
   - Check that the keystore and truststore passwords match the current passwords for the keystore and truststore of your IDM 5.5 deployment.

   Depending on the level of customization you have made in your current deployment, it might be simpler to start with your IDM 5.5 `boot.properties` file, and copy all customized settings from that file to the corresponding IDM 6.0 file. However, as a best practice, you should keep all configuration customizations (including new properties and changed settings) in a single location. You can then copy and paste these changes as appropriate.

5. Security files: Copy the contents of your IDM 5.5 `security\` folder to the IDM 6.0 instance.

   Examine the following excerpt from the `boot.properties` file. IDM automatically prepends the locations of the `keystore.jceks` and `truststore` files with the installation directory.

```
...
openidm.keystore.type=JCEKS
openidm.truststore.type=JKS
openidm.keystore.provider=SunJCE
openidm.truststore.provider=SUN
openidm.keystore.location=security/keystore.jceks
openidm.truststore.location=security/truststore
```

6. Scripts: Migrate any custom scripts or default scripts that you have modified to the scripts directory of your IDM 6.0 instance. In general, custom and customized scripts should be located in the `openidm-5.5\script` directory on the IDM 5.5 deployment:

   - For custom scripts, review "*Compatibility*" in the *Release Notes*. If you're confident that the scripts will work as intended on IDM 6.0, then copy these scripts to the new instance. For example:

```
PS C:\> cd \path\to\openidm-6.0
PS C:\> cp \path\to\openidm-5.5\script\my-custom-script.js .\script
```

   - If you modified an existing IDM 5.5 script, compare the default versions of the IDM 5.5 and IDM 6.0 scripts. If you verify that nothing has changed, review what you've customized against "*Compatibility*" in the *Release Notes*. If you're confident that your changes will work as intended, then copy the customized scripts to the new `openidm-6.0\script` directory. For example:

```
PS C:\> cd \path\to\openidm-6.0
PS C:\> cp \path\to\openidm-5.5\script\policy.js .\script\
```

- If a default script has changed since the IDM 5.5 release, copy the modified script to the `openidm-6.0\script` directory. For example:

```
PS C:\> cd \path\to\openidm-6.0
PS C:\> cp bin\default\script\linkedView.js .\script
```

  Check that your customizations work as expected, then port the changes to the new script in the `openidm-6.0\script` directory.

7. Provisioner files: Modify any customized provisioner configurations in your existing project to point to the connectors that are provided with IDM 6.0. Specifically, make sure that the `connectorRef` properties reflect the new connectors, where applicable. For example:

```
"connectorRef" : {
      "bundleName": "org.forgerock.openicf.connectors.ldap-connector",
      "bundleVersion": "[1.4.0.0,1.5.0.0)",
      "connectorName": "org.identityconnectors.ldap.LdapConnector"
},
```

   Alternatively, copy the connector .jar files from your existing installation into the `openidm\connectors\` folder of the new installation.

8. Complete the IDM 6.0 installation, as described in "*Preparing to Install and Run Servers*".

9. As there is no automated way to migrate a customized configuration to IDM 6.0, we recommend the following strategy:

   - Start with the default IDM 5.5 configuration.
   - For each configuration file that you have customized, use a file comparison tool such as the Windows **fc.exe** utility to assess the differences between your customized file and the IDM 6.0 file.
   - Based on the results of the **fc.exe** review, use either your existing file as a base and port the IDM 6.0 changes to that file, or vice versa. Ultimately, you want to preserve your customizations but ensure that you are up to date with the latest default configuration. All files should end up in the `openidm-6.0/conf` directory.

10. If you are using the UI, clear your browser cache after the migration. The browser cache contains files from the previous release, that might not be refreshed when you log in to the new UI.

11. Start IDM 6.0:

```
PS C:\> cd \path\to\openidm-6.0
PS C:\> .\startup.bat
```

12. Test that your existing clients and scripts are working as intended.

4.4. Applying the IDM 6.0.0.7 Patch Bundle Release

You can only run an update to IDM 6.0.0.7 from versions 6.0 and higher.

Note

The process varies, depending on your current IDM version. For versions 6.0 to 6.0.0.4, the update is a two-step process where you must first download and apply a pre-patch file, then run the update.

If you are on IDM 6.0.0.5, you can skip the pre-patch process.

If you are on a version prior to 6.0, you must first update to 6.0. For more information, see "Update to IDM 6.0".

Run the following procedures:

- "To Prepare Your Patch Bundle Release".
- "To Apply the 6.0.0.7 Patch Bundle Release".

To Prepare Your Patch Bundle Release

The following procedure depends on the IDM version that you are updating from:

1. If you are currently on IDM 6.0 - 6.0.0.4, download the pre-patch file from ForgeRock's BackStage site.
   - For IDM 6.0.0, 6.0.0.1, or 6.0.0.2, download IDM-6.0.0.5-pre-patch-from-6.0.0-6.0.0.2.zip.
   - For IDM 6.0.0.3 or 6.0.0.4, download IDM-6.0.0.5-pre-patch-from-6.0.0.3-6.0.0.4.zip.
2. Copy the pre-patch file to `/path/to/openidm/bin/update`.
3. Download the `IDM-6.0.0.7.zip` from ForgeRock's BackStage site.
4. Copy `IDM-6.0.0.7.zip` to `/path/to/openidm/bin/update`.
5. Back up your 6.0.0.x deployment. Save any customized `*.json` configuration files, located in your project's `/conf` directory. Save your custom directories.
6. If you have a read-only deployment, mount the directory in read-write mode before starting the update.
7. If you integrated IDM with AM, disable any authentication modules that are in use.
8. If you have a custom `resolver/boot.properties` file in your IDM 6.0.0.x deployment, you will need to copy the file to your 6.0.0.7 deployment.

   For example, if you have an IDM 6.0 deployment, extract `IDM-6.0.0.7.zip` to a temporary directory. Then, copy the custom IDM 6.0 `resolver/boot.properties` file to your 6.0.0.7 `resolver` directory.

If you have not customized the default `resolver/boot.properties` file in your deployment, you can simply overwrite it with version 6.0.0.7 of this file.

9. Start IDM. IDM must be running when you launch an update.

> **Note**
>
> You must use the CLI to update your system. As of IDM 6.0, the facility to update servers through the Admin UI has been removed.

10. Disable and re-enable connections to AM.

To Apply the 6.0.0.7 Patch Bundle Release

1. Go to your IDM installation:

```
$ cd /path/to/openidm
```

2. Run the **cli.sh** command to apply the pre-patch zip:

```
$ ./cli.sh update \
  --acceptLicense \
  --user openidm-admin:openidm-admin \
  --url http://localhost:8080/openidm \
  --skipRepoUpdatePreview \
  IDM-6.0.0.5-pre-patch-from-6.0.0.3-6.0.0.4.zip
```

> **Note**
>
> If you are updating from IDM 6.0.0, 6.0.0.1, or 6.0.0.2, use `IDM-6.0.0.5-pre-patch-from-6.0.0-6.0.0.2.zip`.

The update process continues and completes with "Scheduler has been resumed."

```
Executing ./cli.sh...
Starting shell in /openidm
License was accepted via command line argument.
Repository update preview was skipped.
Pausing the Scheduler
Scheduler has been paused.
Waiting for running jobs to finish.
All running jobs have finished.
Entering into maintenance mode...
Now in maintenance mode.
Installing the update archive IDM-6.0.0.5-pre-patch-from-6.0.0.3-6.0.0.4.zip
Update procedure is still processing...
The update process is complete.
Exiting maintenance mode...
No longer in maintenance mode.
Resuming the job scheduler.
Scheduler has been resumed..
```

3. Restart IDM.

4. Run the **cli.sh** command to apply the IDM-6.0.0.7.zip:

```
$ ./cli.sh update \
  --acceptLicense \
  --user openidm-admin:openidm-admin \
  --url http://localhost:8080/openidm \
  --skipRepoUpdatePreview \
  IDM-6.0.0.7.zip
```

   The update process continues and completes with "Scheduler has been resumed."

```
Executing ./cli.sh...
Starting shell in /openidm
License was accepted via command line argument.
Repository update preview was skipped.
Pausing the Scheduler
Scheduler has been paused.
Waiting for running jobs to finish.
All running jobs have finished.
Entering into maintenance mode...
Now in maintenance mode.
Installing the update archive IDM-6.0.0.7.zip
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
Update procedure is still processing...
The update process is complete.
Exiting maintenance mode...
No longer in maintenance mode.
Resuming the job scheduler.
Scheduler has been resumed..
```

   Note

   You may see the following intermittent error during the update process, which you can ignore:

```
Error encountered while checking status of install.  Retrying 8 more times
```

   The error occurs when attempting to get the update status but does not interrupt the process.

5. Shutdown IDM.

6. Manually remove the oldest version of `bundle/openidm-repo-opendj-<version>`, which was generated from the release prior to the 6.0.0.5 update.

   For example, `bundle/openidm-repo-opendj-6.0.0.4.jar.old-1557935520313`.

7. If you are updating from versions IDM 6.0.0 through IDM 6.0.0.3 to this release, you must clear the `reconprogressstate` data from your repository by running a Groovy script.

Note

This step is not necessary when updating from IDM 6.0.0.4 or 6.0.0.5.

Run the following Groovy script to clear the `reconprogressstate` data in your repository:

```
def result = openidm.query(
  "repo/reconprogressstate", [ "_queryFilter" : "true", "_fields" : "_id" ]).result;
for ( item in result ) {
  openidm.delete("repo/reconprogressstate/" + item["_id"], null);
}
return result.size() + " reconprogressstate records deleted";
```

This script will work regardless of the type of repository, and can be sent as a REST call. For example:

```
curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --header "Content-Type: application/json" \
 --request POST \
 --data '{
   "type":"groovy",
   "source":"def result = openidm.query(\"repo/reconprogressstate\", [ \"_queryFilter\" : \"true\",
 \"_fields\" : \"_id\" ]).result; for ( item in result ) { openidm.delete(\"repo/reconprogressstate/\"
 + item[\"_id\"], null); }; return result.size() + \" reconprogressstate records deleted\";"
 }' \
 "http://localhost:8080/openidm/script?_action=eval"
"1 reconprogressstate records deleted"
```

8. Manually update the `conf/ui-themeconfig.json`. Change the Bootstrap version to `css/bootstrap-3.4.1-custom.css` from the previous 3.3.7 version.

   The update does not touch this file, to avoid overwriting possible customization of the UI theme.

9. Restart your server.

   Your update has successfully completed.

Note

There is a known issue that could arise when running your update. When running a pause scheduler job using a REST call (`scheduler/job?_action=pauseJobs`), the update can possibly end up in an infinite loop (see OPENIDM-11265: Unable to pause scheduler jobs with REST call).

The workaround is to clear out the `schedulerobjects` and `schedulerobjectproperties` tables before the update and later recreate all scheduler jobs.

Note

During the upgrade to version 6.0.0.7, you may see an exception for `registerFilter` from `org.forgerock.openidm.jetty.LargePayloadServletFilter` in the IDM logs. You can ignore this message, as it is a harmless exception.

4.5. Placing a Server in Maintenance Mode

The Maintenance Service disables non-essential services of a running IDM instance, in preparation for an update to a later version. When maintenance mode is enabled, services such as recon, sync, scheduling, and workflow are disabled. The complete list of disabled services is output to the log file.

The router remains functional and requests to the `maintenance` endpoint continue to be serviced. Requests to endpoints that are serviced by a disabled component return the following response:

```
404 Resource endpoint-name not found
```

Before you enable maintenance mode, you should temporarily suspend all scheduled tasks. For more information, see "Pausing Scheduled Jobs" in the *Integrator's Guide*.

You can enable and disable maintenance mode over the REST interface.

To enable maintenance mode, run the following command:

```
$ curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request POST \
 "http://localhost:8080/openidm/maintenance?_action=enable"
{
  "maintenanceEnabled": true
 }
```

When the update process starts, maintenance mode is enabled automatically. Before the update process is complete, maintenance mode is disabled. You can disable maintenance mode over REST with the following command:

```
$ curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request POST \
 "http://localhost:8080/openidm/maintenance?_action=disable"
{
  "maintenanceEnabled": false
}
```

To check whether a server is in maintenance mode, run the following command:

```
$ curl \
 --header "X-OpenIDM-Username: openidm-admin" \
 --header "X-OpenIDM-Password: openidm-admin" \
 --request POST \
 "http://localhost:8080/openidm/maintenance?_action=status"
{
  "maintenanceEnabled": false
 }
```

If the server is in maintenance mode, the command returns `"maintenanceEnabled": true`, otherwise it returns `"maintenanceEnabled": false`.

4.6. Update Messages

You can review the events of the update process in the IDM log files. During the update process, you'll find these events in the `openidm0.log.0` file in the `/path/to/openidm/logs` directory.

After the IDM update is complete, it moves that information to a `openidm0.log.1` file, and then creates a new `openidm0.log.0` file. You may find error messages in either file.

When you look through these files, you'll see straightforward INFO messages such as:

- `Upgrading to: 6.0.0.7`
- INFO: Updating configuration file

If there are problems, you may also see self-explanatory messages such as:

- Encrypted zip files are not supported
- Update is not currently running

Error Messages During the Update Process

Error	Explanation (if needed)
Cannot instantiate service without OSGiFrameworkService	Problem with the OSGi container; the default is Apache Felix, as described in "*Architectural Overview*" in the *Integrator's Guide*
Cannot create temporary directory to unzip archive	Suggests a permissions issue with creating directories, possibly due to a read-only installation of IDM, such as described in "*Installing on a Read-Only Volume*".
Messages related to checksums	Without checksums, IDM can't verify files to be updated. For more information, see "Files Changed During the Update Process"
Messages related to file state	Review "Update File States" for status messages
Messages related to the license file	License file are available in the following directory: `/path/to/openidm/legal-notices`

Appendix A. Installing on a Read-Only Volume

Some enterprises choose to enhance security of their applications by installing them on a dedicated read-only (ro) filesystem volume. This appendix describes how you can set up IDM on such a volume.

This appendix assumes that you have prepared the read-only volume appropriate for your Linux/UNIX installation environment.

A.1. Preparing Your System

Before you continue, read "*Preparing to Install and Run Servers*", as well as the prerequisites described in "*Before You Install*" in the *Release Notes*.

This appendix assumes that you have set up a regular Linux user named `idm` and a dedicated volume for the `/idm` directory.

Configure the dedicated volume device, `/dev/volume` in the `/etc/fstab` file, as follows:

```
/dev/volume   /idm   ext4   ro,defaults   1,2
```

When you run the **mount -a** command, the `/dev/volume` volume device gets mounted on the `/idm` directory.

You can switch between read-write and read-only mode for the `/idm` volume with the following commands:

```
$ sudo mount -o remount,rw /idm
$ sudo mount -o remount,ro /idm
```

You can confirm the result with the **mount** command, which should show whether the `/idm` volume is mounted in read-only or read-write mode:

```
/dev/volume on /idm type ext4 (ro)
```

Set up the `/idm` volume in read-write mode:

```
$ sudo mount -o remount,rw /idm
```

With the following commands, you can unpack the IDM binary in the `/idm` directory, and give user `idm` ownership of all files in that directory:

```
$ sudo unzip /idm/IDM-6.0.0.7.zip
$ sudo chown -R idm.idm /idm
```

A.2. Redirect Output Through Configuration Files

In this section, you will modify appropriate configuration files to redirect data to writable volumes. This procedure assumes that you have a user `idm` with Linux administrative (superuser) privileges.

1. Create an external directory where IDM can send logging, auditing, and internal repository information.

   ```
   $ sudo mkdir -p /var/log/openidm/audit
   $ sudo mkdir /var/log/openidm/logs
   $ sudo mkdir -p /var/cache/openidm/felix-cache
   $ sudo mkdir /var/run/openidm
   ```

   Note

   You can also route audit data to a remote data store. For an example of how to send audit data to a MySQL repository, see "*Directing Audit Information To a MySQL Database*" in the *Samples Guide*.

2. Give user `idm` ownership of the newly created directories:

   ```
   $ sudo chown -R idm.idm /var/log/openidm
   $ sudo chown -R idm.idm /var/cache/openidm
   $ sudo chown -R idm.idm /var/run/openidm
   ```

3. Open the audit configuration file for your project, *`project-dir`*`/conf/audit.json`.

   Make sure `handlerForQueries` is set to `json`.

   Redirect the `logDirectory` property to the newly created `/var/log/openidm/audit` subdirectory:

```
{
   "auditServiceConfig" : {
      "handlerForQueries" : "json",
      "availableAuditEventHandlers" : [
         "org.forgerock.audit.handlers.csv.CsvAuditEventHandler",
         "org.forgerock.audit.handlers.elasticsearch.ElasticsearchAuditEventHandler",
         "org.forgerock.audit.handlers.jms.JmsAuditEventHandler",
         "org.forgerock.audit.handlers.json.JsonAuditEventHandler",
         "org.forgerock.openidm.audit.impl.RepositoryAuditEventHandler",
         "org.forgerock.openidm.audit.impl.RouterAuditEventHandler",
         "org.forgerock.audit.handlers.splunk.SplunkAuditEventHandler",
         "org.forgerock.audit.handlers.syslog.SyslogAuditEventHandler"
      ]
    ...
   },
   "eventHandlers" : [
      {
         "class" : "org.forgerock.audit.handlers.json.JsonAuditEventHandler",
         "config" : {
            "name" : "json",
            "logDirectory" : "/var/log/openidm/audit",
            "buffering" : {
                "maxSize" : 100000,
                "writeInterval" : "100 millis"
            },
         "topics" : [ "access", "activity", "recon", "sync", "authentication", "config" ]
    ...
```

4. Open the logging configuration file for your project: *project-dir*`/conf/logging.properties`.

   Find the `java.util.logging.FileHandler.pattern` property and redirect it as shown:

   ```
   java.util.logging.FileHandler.pattern = /var/log/openidm/logs/openidm%u.log
   ```

5. Open the configuration properties file for your project: *project-dir*`/conf/config.properties`.

   Activate the `org.osgi.framework.storage` property. Activate and redirect the `felix.cache.rootdir` property and change them as shown:

   ```
   # If this value is not absolute, then the felix.cache.rootdir controls
   # how the absolute location is calculated. (See buildNext property)
   org.osgi.framework.storage=${felix.cache.rootdir}/felix-cache

   # The following property is used to convert a relative bundle cache
   # location into an absolute one by specifying the root to prepend to
   # the relative cache path. The default for this property is the
   # current working directory.
   felix.cache.rootdir=/var/cache/openidm
   ```

Note

You may want to set up additional redirection. Watch for the following configuration details:

- Connectors. Depending on the connector, and the read-only volume, you may need to configure connectors to direct output to writable volumes.
- Scripts. If you're using Groovy, examine the `conf/script.json` file for your project. Make sure that output such as to the `groovy.target.directory` is directed to an appropriate location, such as `idm.data.dir`

A.3. Additional Details

In a production environment, you must configure a supported repository, as described in "*Selecting a Repository*".

Disable monitoring of JSON configuration files. To do so, open the *`project-dir`*`/conf/system.properties` file, and activate the following option:

```
openidm.fileinstall.enabled=false
```

You should address one more detail, the value of the `OPENIDM_PID_FILE` in the `startup.sh` and `shutdown.sh` scripts.

For RHEL 6 and Ubuntu 14.04 systems, the default shell is bash. You can set the value of `OPENIDM_PID_FILE` for user `idm` by adding the following line to `/home/idm/.bashrc`:

```
export OPENIDM_PID_FILE=/var/run/openidm/openidm.pid
```

If you have set up a different command line shell, adjust your changes accordingly.

When you log in again as user `idm`, your `OPENIDM_PID_FILE` variable should redirect the process identifier file, `openidm.pid` to the `/var/run/openidm` directory, ready for access by the `shutdown.sh` script.

You need to set up security keystore and truststore files, either by importing a signed certificate or by generating a self-signed certificate. For more information, see "*Securing and Hardening Servers*" in the *Integrator's Guide*.

While the volume is still mounted in read-write mode, start IDM normally:

```
$ ./startup.sh -p project-dir
```

The first startup of IDM either processes the signed certificate that you added, or generates a self-signed certificate.

Stop IDM:

```
-> shutdown
```

You can now mount the `/idm` directory in read-only mode. The configuration in `/etc/fstab` ensures that Linux mounts the `/idm` directory in read-only mode the next time that system is booted.

```
$ sudo mount -o remount,ro /idm
```

You can now start IDM, configured on a secure read-only volume.

```
$ ./startup.sh -p project-dir
```

IDM Glossary

correlation query	A correlation query specifies an expression that matches existing entries in a source repository to one or more entries on a target repository. While a correlation query may be built with a script, it is *not* a correlation script. As noted in "Correlating Source Objects With Existing Target Objects" in the *Integrator's Guide*, you can set up a query definition, such as `_queryId`, `_queryFilter`, or `_queryExpression`, possibly with the help of a `linkQualifier`.
correlation script	A correlation script matches existing entries in a source repository, and returns the IDs of one or more matching entries on a target repository. While it skips the intermediate step associated with a `correlation query`, a correlation script can be relatively complex, based on the operations of the script.
entitlement	An entitlement is a collection of attributes that can be added to a user entry via roles. As such, it is a specialized type of `assignment`. A user or device with an entitlement gets access rights to specified resources. An entitlement is a property of a managed object.
JSON	JavaScript Object Notation, a lightweight data interchange format based on a subset of JavaScript syntax. For more information, see the JSON site.
JSON Pointer	A JSON Pointer defines a string syntax for identifying a specific value within a JSON document. For information about JSON Pointer syntax, see the JSON Pointer RFC.

JWT	JSON Web Token. As noted in the *JSON Web Token draft IETF Memo*, "JSON Web Token (JWT) is a compact URL-safe means of representing claims to be transferred between two parties." For IDM, the JWT is associated with the `JWT_SESSION` authentication module.
managed object	An object that represents the identity-related data managed by IDM. Managed objects are configurable, JSON-based data structures that IDM stores in its pluggable repository. The default configuration of a managed object is that of a user, but you can define any kind of managed object, for example, groups or roles.
mapping	A policy that is defined between a source object and a target object during reconciliation or synchronization. A mapping can also define a trigger for validation, customization, filtering, and transformation of source and target objects.
OSGi	A module system and service platform for the Java programming language that implements a complete and dynamic component model. For more information, see What is OSGi? Currently, only the Apache Felix container is supported.
reconciliation	During reconciliation, comparisons are made between managed objects and objects on source or target systems. Reconciliation can result in one or more specified actions, including, but not limited to, synchronization.
resource	An external system, database, directory server, or other source of identity data to be managed and audited by the identity management system.
REST	Representational State Transfer. A software architecture style for exposing resources, using the technologies and protocols of the World Wide Web. REST describes how distributed data objects, or resources, can be defined and addressed.
role	IDM distinguishes between two distinct role types - provisioning roles and authorization roles. For more information, see "*Working With Managed Roles*" in the *Integrator's Guide*.
source object	In the context of reconciliation, a source object is a data object on the source system, that IDM scans before attempting to find a corresponding object on the target system. Depending on the defined mapping, IDM then adjusts the object on the target system (target object).
synchronization	The synchronization process creates, updates, or deletes objects on a target system, based on the defined mappings from the source system. Synchronization can be scheduled or on demand.

system object	A pluggable representation of an object on an external system. For example, a user entry that is stored in an external LDAP directory is represented as a system object in IDM for the period during which IDM requires access to that entry. System objects follow the same RESTful resource-based design principles as managed objects.
target object	In the context of reconciliation, a target object is a data object on the target system, that IDM scans after locating its corresponding object on the source system. Depending on the defined mapping, IDM then adjusts the target object to match the corresponding source object.

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