Moab HPC Suite – Enterprise Edition

Installation and Configuration Guide 8.1.1

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Welcome to the Moab HPC Suite – Enterprise Edition Installation and Configuration Guide

Welcome to the *Moab HPC Suite – Enterprise Edition Installation and Configuration Guide 8.1.1*, which will help you install or upgrade and configure your Moab HPC Suite. This guide includes detailed instructions for installing each component of the suite so that you can quickly get up and running.

This guide is intended for system administrators who are responsible for installing the Moab HPC Suite – Enterprise Edition. The Moab HPC Suite – Enterprise Edition 8.1.1 contains the following components:

- Moab Workload Manager 8.1.1
- Moab Web Services 8.1.1
- Moab Accounting Manager 8.1.1
- TORQUE 5.1.1

Before commencing the installation or upgrade, please see Requirements on page 3 to verify your system conforms to minimum prerequisites.

Chapter 1 Requirements

It is highly recommended that you *first* perform installations and upgrades in a *test environment*. Standard installation and upgrade procedures and use cases are tested prior to release. However, due to the wide range of possible configurations and customizations, it is important to exercise caution when deploying new versions of software into your production environments. This is especially true when the workload has vital bearing on your organization's day-to-day operations. We recommend that you test in an environment that mirrors your production environment's configuration, workflow and load as closely as possible. Please contact your Adaptive Computing account manager for suggestions and options for installing / upgrading to newer versions.

There are many different ways to install and configure Moab HPC Suite. Each environment has its own set of requirements and preferences. The following installation instructions are intended to help an administrator understand how each of the Moab HPC Suite components interact and how to install and configure each one. Two approaches have been documented: the "Manual installation" and the "RPM installation". Only one approach is required for installation; do not try to follow both sets of instructions on a single system.

Please note the following:

- Moab Accounting Manager is available only with the Moab HPC Enterprise Suite.
- Smaller environments may elect to consolidate the TORQUE Head Node with the Moab Head Node, including PBS Server in the list of components installed on the Moab Head Node.
- The Requirements section gives further clarification regarding what each component requires.
- Although Moab Workload Manager and Moab Accounting Manager may share the same database instance, it is not a requirement. Two database instances may be used, one for each component. See the Requirements section for more information about what databases are supported.
- Larger systems will require more dedicated resources for each component, in which case it may be necessary to move individual components from the Moab Head Node (i.e. databases, Moab Accounting Manager) to their own respective servers.
- The Message Queue component is fulfilled by ZeroMQ™. The libraries are provided with the components that use the message queue and are enabled via configuration; no special installation is necessary.

Where to Start

1. Begin by reading the Requirements section below. Whether installing manually or with RPMs, it is important to be familiar with the hardware and software requirements.
2. Decide whether you will perform a manual installation or an RPM installation.
   - The manual installation provides advantages to administrators who want to pick and choose what components to install and administrators who want non-standard configure options.
   - The RPM installation provides advantages to administrators who want a fairly standard installation with TORQUE Resource Manager, Moab Workload Manager, Moab Accounting Manager, and Moab Web Services installed on one server.

     RPM installation only supports installation for small to medium (with out large throughput) installation types and only on CentOS, RHEL, or Scientific Linux systems. For other system types or for other supported operating systems, refer to the manual installation instructions.

   Then follow the appropriate installation instructions.

   Code samples have been provided for convenience. Some code samples provide sample passwords (i.e. "changeme!"). We strongly recommend that you do not use these passwords during installation, as using the documented passwords could introduce unnecessary security vulnerabilities into your system.
3. The "Additional Configuration" section in both the manual and the RPM installation instructions provide additional information and instructions for optional, but recommended configurations (i.e. Configuring SSL in Tomcat, etc.).
4. See Troubleshooting on page 135 for assistance in addressing common problems during installation and configuration.
5. See Component Documentation on page 145 for links to additional administrator and reference guides.

Requirements

Moab HPC Suite

Hardware Requirements

The following are the minimum hardware requirements for an average environment. Larger environments should consider allocating more resources and/or spreading components across multiple servers. Please consult the table below for recommendations.

Type	# of Compute Nodes	Jobs/ week	Minimum Requirements (per Head Node distribution)	Recommended Requirements (targeting minimum number of servers)
Proof of Concept / Small Demo	50	<1k	**Moab+TORQUE Head Node:** • 4 Intel/AMD x86-64 cores • At least 8 GB RAM • At least 100 GB dedicated disk space	Same as minimum
Medium	500	<100k	**Moab+TORQUE Head Node:** • 8 Intel/AMD x86-64 cores • At least 16 GB RAM • At least 512 GB dedicated disk space	**Moab+TORQUE Head Node:** • 16 Intel/AMD x86-64 cores • At least 32 GB RAM • At least 1 TB dedicated disk space
Medium with High Throughput or Larger	>500	>100k	**Moab Head Node:** • 8 Intel/AMD x86-64 cores • At least 16 GB RAM • At least 512 GB dedicated disk space **TORQUE Head Node:** • 8 Intel/AMD x86-64 cores • At least 16 GB RAM • At least 512 GB dedicated disk space	We recommend separating components onto separate servers where possible (some components should not be separated; see Requirements below). Specific requirements around the intended configuration and use of Moab HPC Suite will help determine suite topology and resource allocation.

Please note the following:

- All requirements above (minimum and recommended) target a minimum number of management servers. Administrators are encouraged to separate the TORQUE and Moab head nodes where possible for better results, especially when High Throughput is enabled.
- Although many factors may have an impact on performance (network bandwidth, intended use and configuration, etc.), we consider High Throughput as something that makes a significant enough difference between minimum and recommended hardware requirements to merit mention in the table above.
- Moab and TORQUE are both multi-threaded and perform better with more processors.
- Regarding disk space, consideration should be given to requirements related to log files, log depth, number of jobs/nodes/reservations (more objects impact database journal size), average number of events generated (more events take more space), etc.

Software Requirements

The installation documentation provides more details regarding how to install and configure the following software requirements. The information provided below is for your information only. No action is necessary.

Software requirements are listed per-component rather than suite-wide to make it easier for administrators who wish to install components on separate servers.

TORQUE

Supported Operating Systems

- CentOS 6.x, 7.x
- RHEL 6.x, 7.x
- Scientific Linux 6.x, 7.x
- SUSE Linux Enterprise Server 11, 12

CentOS 5.9, RHEL 5.9, and Scientific Linux 5.9 are supported, largely to continue support for clusters where the compute nodes operating systems cannot be upgraded. We recommend that the TORQUE head node run on the supported operating systems listed above.

Software Requirements

- libxml2-devel package (package name may vary)
- openssl-devel package (package name may vary)

- Tcl/Tk version 8 or later if you plan to build the GUI portion of TORQUE or use a Tcl based scheduler
- If your configuration uses cpusets, you must install libhwloc; the corresponding hwloc-devel package is also required. See **Linux Cpuset Support** in the *TORQUE Administrator Guide*

> libwloc 1.2 is required for TORQUE 5.1.x or 5.0.x; 1.1 is required for TORQUE 4.2.x.

If you intend to use TORQUE 5.1.1 with Moab Workload Manager, you must run Moab version 8.1.1 or 8.0.x. TORQUE 5.1.1 will not work with versions earlier than Moab 8.0.

If you build TORQUE from source (i.e. clone from github), the following additional software is required:

- gcc
- gcc-c++
- A posix compatible version of make
- libtool 1.5.22
- boost-devel 1.36.0

> Version 1.36.0 or newer is supported. RHEL 5, CentOS 5, and Scientific Linux 5 come packaged with an unsupported version. RHEL 6, CentOS 6, and Scientific Linux 6 come packaged with 1.41.0 and RHEL 7, CentOS 7, and Scientific Linux 7 come packaged with 1.53.0. If needed, use the --with-boost-path=DIR option to change the packaged boost version. See **Customizing the Install** in the *TORQUE Resource Manager Adminstrator Guide*.

Moab Workload Manager

Supported Operating Systems

- CentOS 6.x, 7.x
- RHEL 6.x, 7.x
- Scientific Linux 6.x, 7.x
- SUSE Linux Enterprise Server 11, 12

Software Requirements

- libcurl (http://curl.haxx.se/libcurl/)
- Perl 5.8.8 or later
- perl-CPAN (package name may vary)

- libxml2-devel (package name may vary)
- *(Optional)* Moab Accounting Manager 8.1
- *(Optional)* MySQL, PostgreSQL, or Oracle with ODBC driver; see **Database Configuration** in the *Moab Workload Manager Administrator Guide* for details

Supported Resource Managers

- TORQUE 5.1
- SLURM

Moab Accounting Manager

MAM is commonly installed on the same host as Moab Workload Manager; however, in some cases you might obtain better performance by installing them on separate hosts.

Supported Operating Systems

- CentOS 6.x, 7.x
- RHEL 6.x, 7.x
- Scientific Linux 6.x, 7.x
- SUSE Linux Enterprise Server 11, 12

Software Requirements

- gcc
- perl-suidperl
- httpd
- mod_ssl
- rrdtool
- Moab® Workload Manager 8.1
- Perl modules; see Installing Moab Accounting Manager on page 25 for more details

Depends On (not necessarily on the same server)

MAM uses an RDBMS as a back end.

- PostgreSQL 7.2 or later

Moab Web Services

MWS should be installed on the same host as Moab® Workload Manager.

Supported Operating Systems

- CentOS 6.x, 7.x
- RHEL 6.x, 7.x
- Scientific Linux 6.x, 7.x
- SUSE Linux Enterprise Server 11, 12

Software Requirements

- Moab® Workload Manager 8.1
- Apache Tomcat™
  - 6 for SUSE 11-based systems
  - 7 for Red Hat 6-Based, Red Hat 7-based or SUSE 12-based systems
- Oracle® Java® 7 Runtime Environment

  Oracle Java 7 Runtime Environment is the recommended Java environment, but Oracle Java 6 is also supported. All other versions of Java, including OpenJDK/IcedTea, GNU Compiler for Java, and so on cannot run Moab Web Services.
- MongoDB® 2.4.x

Depends On (not necessarily on the same server)

- OpenLDAP *or* PAM; see **Configuring Moab Web Services** in the *Moab Web Services Reference Guide*.

  MWS does not support LDAP *and* PAM authentication at the same time.

Chapter 2 Manual Installation Guide

This chapter provides installation, configuration, and upgrading information using the manual install process.

Related Topics

- Requirements on page 3
- Preparing for Manual Installation on page 12

Installation

In this section:

Preparing for Manual Installation

The manual installation process of the Moab HPC Suite includes installing the separate components in the suite. This guide contains detailed instructions for installing each component.

Many individual components have dependencies on other components (see Requirements on page 3). However, if you do not require a certain component (Moab Web Services, for example), you do not have to install it.

The install instructions for each component include information about system requirements and dependencies. Some include prerequisite instructions that you will need to complete before you begin the install. Please read this information carefully, and make sure you have installed all the dependencies and packages that are necessary in order to avoid errors during the Moab HPC Suite install process.

Because many system-level files and directories are accessed during the installation, the instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

Enable Extra Packages for the Repository

Many individual components have dependencies that are found in the optional add-on repositories for the distribution. You must enable the respective repository for your distribution on all hosts upon which you install Adaptive Computing software components.

- Red Hat-based systems

```
[root]# yum install epel-release
```

> On RHEL systems, if your system is not registered to Red Hat Subscription Management, you will need to install the epel release rpm from the Fedora repo. The exact epel release version can vary over time, but the command should be similar to the following:
>
> RHEL 6
>
> ```
> [root]# rpm -Uvh http://dl.fedoraproject.org/pub/epel/6/x86_64/epel-release-6-8.noarch.rpm
> ```
>
> RHEL 7
>
> ```
> [root]# rpm -Uvh http://dl.fedoraproject.org/pub/epel/7/x86_64/e/epel-release-7-5.noarch.rpm
> ```

- SUSE-based systems
  1. Verify that you have a licensed installation of SLES 11 or 12.
  2. Download the SUSE Linux Enterprise 11 or 12 Software Development Kit e-Media Kit and add the ISO to the repository.
  3. Add the `devel:languages:perl repo` for your SLES version to the your software repositories. For example, if you are using SLES 12, you might use the following commands:

```
[root]# zypper addrepo
http://download.opensuse.org/repositories/devel:languages:perl/SLE_12/devel:languages:perl.repo
[root]# zypper refresh
```

Install the Moab HPC Suite Software Components

To install the Moab HPC Suite, install the packages in the following order:

1. Install TORQUE. See Installing TORQUE on page 13.
2. Install Moab Workload Manager. See Installing Moab Workload Manager on page 20.
3. Install Moab Accounting Manager. See Installing Moab Accounting Manager on page 25.
4. Install Moab Web Services. See Installing Moab Web Services on page 39.

Installing TORQUE

This topic contains instructions on how to install and start TORQUE.

In this topic:

Requirements

Supported Operating Systems

- CentOS 6.x, 7.x
- RHEL 6.x, 7.x
- Scientific Linux 6.x, 7.x
- SUSE Linux Enterprise Server 11, 12

> CentOS 5.9, RHEL 5.9 and Scientific Linux 5.9 are supported, largely to continue support for clusters where the compute nodes operating systems cannot be upgraded. We recommend that the TORQUE head node run on the supported operating systems listed above.

Software Requirements

- libxml2-devel package (package name may vary)
- openssl-devel package (package name may vary)
- Tcl/Tk version 8 or later if you plan to build the GUI portion of TORQUE or use a Tcl based scheduler
- If your configuration uses cpusets, you must install libhwloc; the corresponding hwloc-devel package is also required. See **Linux Cpuset Support** in the *TORQUE Resource Manager Administrator Guide*.

  > libwloc 1.2 is required for TORQUE 5.1.x or 5.0.x; 1.1 is required for TORQUE 4.2.x.

If you intend to use TORQUE 5.1.1 with Moab Workload Manager, you must run Moab version 8.1.1 or 8.0.x. TORQUE 5.1.1 will not work with versions earlier than Moab 8.0.

If you build TORQUE from source (i.e. clone from github), the following additional software is required:

- gcc
- gcc-c++
- A posix compatible version of make

- libtool 1.5.22
- boost-devel 1.36.0

> Version 1.36.0 or newer is supported. Red Hat 5 systems come packaged with an unsupported version. Red Hat 6 systems come packaged with 1.41.0 and Red Hat 7 systems packaged with 1.53.0. If needed, use the --with-boost-path=DIR option to change the packaged boost version. See **Customizing the Install** in the *TORQUE Resource Manager Adminstrator Guide*.

Prerequisites

Open Necessary Ports

TORQUE requires certain ports to be open for essential communication:

- For client and pbs_mom communication to pbs_server, the default port is 15001.
- For pbs_server communication to pbs_mom, the default port is 15002.
- For pbs_mom communication to pbs_mom, the default port is 15003.

For more information on how to configure the ports that TORQUE uses for communication, see **Configuring Ports** in the *TORQUE Resource ManagerAdminstrator Guide*.

If you have a firewall enabled, do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the TORQUE server for client and MOM communication
-A INPUT -p tcp --dport 15001 -j ACCEPT

# Needed on the TORQUE MOM for server and MOM communication
-A INPUT -p tcp --dport 15002 -j ACCEPT
-A INPUT -p tcp --dport 15003 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=15001/tcp --permanent
[root]# firewall-cmd --add-port=15002/tcp --permanent
[root]# firewall-cmd --add-port=15003/tcp --permanent
[root]# firewall-cmd --reload
```

- SUSE 11-based and SUSE 12-based systems using SuSEfirewall2

```
[root]# vi /etc/sysconfig/SuSEfirewall2

# Add the following ports to the FW_SERVICES_EXT_TCP parameter as required

# Needed on the TORQUE server for client and MOM communication
FW_SERVICES_EXT_TCP="15001"

# Needed on the TORQUE MOM for server and MOM communication
FW_SERVICES_EXT_TCP="15002 15003"

[root]# service SuSEfirewall2_setup restart
```

Verify the hostname

Make sure your host (with the correct IP address) is in your `/etc/hosts` file. To verify that the hostname resolves correctly, make sure that hostname and hostname -f report the correct name for the host.

Install Dependencies and Packages

Install the `libxml2-devel`, `openssl-devel`, and `boost-devel` packages.

- Red Hat 6-based and Red Hat 7-based systems

```
[root]# yum install libtool openssl-devel libxml2-devel boost-devel gcc gcc-c++
```

- SUSE 11-based and SUSE 12-based systems

```
[root]# zypper install libopenssl-devel libtool libxml2-devel boost-devel gcc
gcc-c++ make gmake
```

- Red Hat-5 based systems

```
[root]# yum install openssl-devel libtool-devel libxml2-devel gcc gcc-c++ wget
```

Use these instructions for installing `libtool`:

```
[root]# cd /tmp
[root]# wget http://ftpmirror.gnu.org/libtool/libtool-2.4.2.tar.gz
[root]# tar -xzvf libtool-2.4.2.tar.gz
[root]# cd libtool-2.4.2
[root]# ./configure --prefix=/usr
[root]# make
[root]# make install
```

TORQUE requires Boost version 1.36.0 or greater. The boost-devel package provided with Red Hat 5-based systems is older than this requirement. A new option, --with-boost-path has been added to configure (see **Customizing the Install** in the *TORQUE Resource Manager Administrator Guide* for more information). This allows you to point TORQUE to a specific version of boost during make. One way to compile TORQUE without installing Boost is to simply download the Boost version you plan to use from: http://www.boost.org/users/history/. Next, untar Boost (you do not need to build it or install it). When you run TORQUE configure, use the --with-boost-path option pointed to the extracted Boost directory.

Install TORQUE

Do the following:

1. Switch the user to root.

```
[user]$ su -
```

2. Download the latest 5.1 build from the Adaptive Computing website. It can also be downloaded via command line (github method or the tarball distribution).
   - Clone the source from github.

     If git is not installed:

     ```
     # Red Hat-based systems
     [root]# yum install git

     # SUSE-based systems
     [root]# zypper install git
     ```

     ```
     [root]# git clone https://github.com/adaptivecomputing/torque.git -b 5.1.1 5.1.1
     [root]# cd 5.1.1
     [root]# ./autogen.sh
     ```

   - Get the tarball source distribution.
     - Red Hat-based systems

       ```
       [root]# yum install wget
       [root]# wget http://www.adaptivecomputing.com/download/torque/torque-
       5.1.1.tar.gz -O torque-5.1.1.tar.gz
       [root]# tar -xzvf torque-5.1.1.tar.gz
       [root]# cd torque-5.1.1/
       ```

- SUSE-based systems

```
[root]# zypper install wget
[root]# wget http://www.adaptivecomputing.com/download/torque/torque-
5.1.1.tar.gz -O torque-5.1.1.tar.gz
[root]# tar -xzvf torque-5.1.1.tar.gz
[root]# cd torque-5.1.1/
```

3. Run each of the following commands in order.

```
[root]# ./configure
[root]# make
[root]# make install
```

For information on what options are available to customize the ./configure command, see **Customizing the Install** in the *TORQUE Resource Manager Adminstrator Guide*.

4. Configure the `trqauthd` daemon to start automatically at system boot.
   - Red Hat 6-based systems

```
[root]# cp contrib/init.d/trqauthd /etc/init.d/
[root]# chkconfig --add trqauthd
[root]# echo /usr/local/lib > /etc/ld.so.conf.d/torque.conf
[root]# ldconfig
[root]# service trqauthd start
```

   - SUSE 11-based systems

```
[root]# cp contrib/init.d/suse.trqauthd /etc/init.d/trqauthd
[root]# chkconfig --add trqauthd
[root]# echo /usr/local/lib > /etc/ld.so.conf.d/torque.conf
[root]# ldconfig
[root]# service trqauthd start
```

   - Red Hat 7-based and SUSE 12-based systems

```
[root]# cp contrib/systemd/trqauthd.service /usr/lib/systemd/system/
[root]# systemctl enable trqauthd.service
[root]# echo /usr/local/lib > /etc/ld.so.conf.d/torque.conf
[root]# ldconfig
[root]# systemctl start trqauthd.service
```

5. Verify that the `/var/spool/torque/server_name` file exists and contains the correct name of the server.

```
[root]# echo <pbs_server's_hostname> > /var/spool/torque/server_name
```

6. By default, TORQUE installs all binary files to `/usr/local/bin` and `/usr/local/sbin`. Make sure the path environment variable includes these directories for both the installation user and the root user.

```
[root]# export PATH=/usr/local/bin/:/usr/local/sbin/:$PATH
```

7. Initialize `serverdb` by executing the `torque.setup` script.

```
[root]# ./torque.setup root
```

8. Add nodes to the `/var/spool/torque/server_priv/nodes` file. For information on syntax and options for specifying compute nodes, see **Specifying Compute Nodes** in the *TORQUE Resource Manager Adminstrator Guide*.
9. Configure the MOMs if necessary. See **Configuring on Compute Nodes** in the *TORQUE Resource Manager Adminstrator Guide*.

   The make packages command can be used to create self-extracting packages that can be copied and executed on your nodes. For information on creating packages and deploying them, see **Compute Nodes** in the *TORQUE Resource Manager Adminstrator Guide*.

10. On the TORQUE Server, configure pbs_server to start automatically at system boot, and then start the daemon.
    - Red Hat 6-based systems

      ```
      [root]# cp contrib/init.d/pbs_server /etc/init.d
      [root]# chkconfig --add pbs_server
      [root]# service pbs_server restart
      ```

    - SUSE 11-based systems

      ```
      [root]# cp contrib/init.d/suse.pbs_server /etc/init.d/pbs_server
      [root]# chkconfig --add pbs_server
      [root]# service pbs_server restart
      ```

    - Red Hat 7-based and SUSE 12-based systems

      ```
      [root]# qterm
      [root]# cp contrib/systemd/pbs_server.service /usr/lib/systemd/system/
      [root]# systemctl enable pbs_server.service
      [root]# systemctl start pbs_server.service
      ```

11. Configure pbs_mom to start automatically at system boot on each compute node, and then start the daemon.

    There are several methods to get the following inti.d scripts on to each node. The following instructions assume the entire contents of contrib/init.d in the TORQUE git repository or source tarball are copied(scp)/cloned to the compute node.

    These options can be added to the self-extracting packages.

    On the TORQUE MOM, do the following:

- Red Hat 6-based systems

```
[root]# cp contrib/init.d/pbs_mom /etc/init.d
[root]# chkconfig --add pbs_mom
[root]# service pbs_mom start
```

- SUSE 11-based systems

```
[root]# cp contrib/init.d/suse.pbs_mom /etc/init.d/pbs_mom
[root]# chkconfig --add pbs_mom
[root]# service pbs_mom start
```

- Red Hat 7-based and SUSE 12-based systems

```
[root]# cp contrib/systemd/pbs_mom.service /usr/lib/systemd/system/
[root]# systemctl enable pbs_mom.service
[root]# systemctl start pbs_mom.service
```

Related Topics

Preparing for Manual Installation on page 12
Installing Moab Workload Manager on page 20

Installing Moab Workload Manager

This topic contains instructions on how to install and start Moab Workload Manager (Moab).

In this topic:

Open Necessary Ports

Moab Workload Manager uses a configurable server port (default 42559) for client-server communication. If you intend to run client commands on a host other than the Moab Head Node, or if you will be using Moab in a grid, and if you have a firewall enabled, then you will need to configure the firewall to allow the server port.

Do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the Moab server for off-host client communication
-A INPUT -p tcp --dport 42559 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
firewall-cmd --add-port=42559/tcp --permanent
firewall-cmd --reload
```

- SUSE 11-based and SUSE 12-based systems

```
[root]# vi /etc/sysconfig/SuSEfirewall2

# Add the following ports to the FW_SERVICES_EXT_TCP parameter as required

# Needed on the Moab server for off-host client communication
FW_SERVICES_EXT_TCP="42559"

[root]# service SuSEfirewall2_setup restart
```

Install Dependencies and Packages

Use the following commands to install the required Moab Workload Manager dependencies and packages.

- Red Hat-based systems

```
[root]# yum update
[root]# yum install make libcurl perl-CPAN libxml2-devel gcc
```

- SUSE-based systems

```
[root]# zypper update
[root]# zypper install make curl libxml2-devel
```

Installing TORQUE on a Separate Server

If you are using TORQUE and are installing the TORQUE server on a separate TORQUE Head Node, you will need to install TORQUE on the Moab Head Node as well in order for Moab to interact with TORQUE. Follow the instructions in Installing TORQUE on page 13 with these exceptions:

- Use the configure options --disable-server, --disable-mom and --disable-gui
- No need to create self-extracting packages with make packages
- Omit the step initializing the serverdb and all of the steps thereafter

Installing Moab Accounting Manager on a Separate Sever

If you are using Moab Accounting Manager and will be using the Native (custom script) accounting manager interface, and are installing Moab Accounting Manager on a separate host, you will need to install Moab Accounting Manager on the Moab Head Node as well in order for the custom scripts to use the MAM API. Follow the instructions in Installing Moab Accounting Manager on page 25 with the following exceptions:

- No need to install the database or database drivers
- Use the configure option --without-init
- Instead of running make, use make clients-only
- Instead of running make install, use make install-clients-only
- Omit the step to create the database and all of the steps thereafter

(Optional) Building a Custom RPM

Do the following:

1. Install `rpm-build`.

```
[root]# yum install rpm-build
```

2. Download the latest Moab build (`moab-<version>-<OS>.tar.gz`) from the Adaptive Computing website.

> The variable marked *<version>* is the desired version of the suite; for example, 8.1.0-2015010514-ed0c40a would be Moab 8.1.0 revision 2015010514 at changeset ed0c40a. The variable marked *<OS>* indicates the OS for which the build was designed.

3. Untar the downloaded package.
4. Change directories into the untarred directory.
5. Edit the ./moab.spec file for RPM customization.
6. Run ./rpm-build.
7. Locate the custom RPM in rpm/RPMS/x86_64.

Install Moab Workload Manager

1. Download the latest Moab build (`moab-<version>-<OS>.tar.gz`) from the Adaptive Computing website.

> The variable marked <*version*> is the desired version of the suite; for example, 8.1.0-2015010514-ed0c40a would be Moab 8.1.0 revision 2015010514 at changeset ed0c40a. The variable marked <*OS*> indicates the OS for which the build was designed.

2. As the root user, run each of the following commands in order.

```
[root]# tar xzvf moab-<version>-<OS>.tar.gz
[root]# cd moab-<version>-<OS>
```

If Elastic Computing is part of your Moab Workload Manager configuration:

```
# Red Hat-based systems
[root]# yum install deps/acpython-base*

# SUSE-based systems
[root]# zypper install deps/acpython-base*
```

3. Configure Moab. For a complete list of `./configure` options, use `./configure --help` or refer to Moab Workload Manager Configuration Options on page 58 for a list of commonly used options.

   It is strongly recommended that you configure Moab with the `--with-init` and `--with-profile` options. The `--with-profile` option makes it easier to execute Moab commands. The `--with-init` option allows Moab to automatically start at OS startup. If you are installing Moab Accounting Manager, configure Moab with the `--with-am` option.

```
[root]# ./configure <options>
```

4. *ONLY* if you are using green computing, *or* if you are using a resource manager other than TORQUE.

   Run the make perldeps command to install the necessary perl modules using CPAN. When first running CPAN, you will be asked for configuration information. It is recommended that you choose an automatic configuration. You will be prompted to provide input during module installation; running the make perldeps command with a script is not recommended.

```
[root]# make perldeps
```

5. Install Moab.

```
[root]# make install
```

6. *ONLY* if you are installing on SLES 11.

   Copy the appropriate `init.d` file, set the permissions on it, and configure Moab to start automatically at system boot.

```
# SLES 11
[root]# cp OS/SLES/etc/init.d/moab /etc/init.d/moab

[root]# chmod 755 /etc/init.d/moab
[root]# chkconfig --add moab
```

7. Modify the Moab configuration file.

```
[root]# vi /opt/moab/etc/moab.cfg
```

Do the following:

a. Verify that **SUBMITCMD** is set up for your TORQUE resource manager and that it points to a valid `qsub` executable. For example:

```
RMCFG[torque] SUBMITCMD=/usr/local/bin/qsub
```

If you use a SLURM resource manager, see **Moab-SLURM Integration Guide** in the *Moab Workload Manager Administrator Guide* for configuration information. If you use a NATIVE resource manager, see **Managing Resources Directly with the Native Interface** in the *Moab Workload Manager Administrator Guide* for configuration information.

b. *ONLY* if you are using Moab Web Services, add *tomcat* to the list of administrator **USERS**. For example:

```
ADMINCFG[1] USERS=root,tomcat
```

8. If you configured with the ./configure --with-profile option, source the following file to add the Moab executable directories to your current shell *$PATH* environment.

```
[root]# . /etc/profile.d/moab.sh
```

9. Copy your license file into the same directory as `moab.cfg` (`/opt/moab/etc/` by default). For example:

```
[root]# cp moab.lic $MOABHOMEDIR/etc/moab.lic
```

To verify the current status of your license, use `moab --about`.

Moab checks the status of the license every day just after midnight. At 60 and 45 days before, and daily from 30 days before license expiration to and including the license expiration date, Moab sends an e-mail to all level 1 administrators informing them of the pending Moab license expiration. A log record is also made of the upcoming expiration event. For the notifications to occur correctly, you must enable administrator email notification (see **Notifying Administrators of Failures** in the *Moab Workload Manager Administrator Guide*) and `moab.cfg` must contain email addresses for level 1 administrators. For example:

```
ADMINCFG[1] USERS=u1,u2,u3[,...]

USERCFG[u1] EMAILADDRESS=u1@company.com
USERCFG[u2] EMAILADDRESS=u2@company.com
USERCFG[u3] EMAILADDRESS=u3@company.com

MAILPROGRAM DEFAULT
```

Moab will not run without a license. For information about obtaining a trial license, please contact Adaptive Computing.

10. Start Moab (assumes Moab configured with the `--with-int` option).
    - Red Hat 6-based or SUSE 11-based systems

      ```
      [root]# chkconfig moab on
      [root]# service moab start
      ```

    - Red Hat 7-based or SUSE 12-based systems

      ```
      [root]# systemctl start moab.service
      ```

11. Submit a sleep job as a non-root user (adaptive is used in this example) and verify the job is running.

    ```
    [root]# su - adaptive
    [adaptive]$ echo sleep 150 | msub
    [adaptive]$ showq
    [adaptive]$ exit
    ```

Related Topics

Preparing for Manual Installation on page 12
Installing TORQUE on page 13

Installing Moab Accounting Manager

This topic contains instructions on how to install and start Moab Accounting Manager (MAM).

Perform the following in order:

- Plan Your Installation on page 26
- Open Necessary Ports on page 26
- Install and Initialize the PostgreSQL Server on page 28
- Install Dependencies, Packages, or Clients on page 29
- (Optional) Build a Custom RPM on page 31
- Install MAM Server on page 32
- Configure the MAM GUI on page 34

- Access the MAM GUI on page 37
- Configure Moab Workload Manager to use Moab Accounting Manager on page 38
- Initialize Moab Accounting Manager on page 38

Plan Your Installation

The first step is determining the number of separate hosts (physical machines) required for your MAM installation.

Your MAM installation includes:

- MAM Server
- MAM Database
- MAM GUI (optional)
- MAM Clients (possibly several hosts)

Each of these components can be installed on their own hosts (meaning the actual physical machine) or can be combined on same hosts. For example, the MAM Database can be installed on the same *host* as the MAM Server. Or the MAM Server may be installed on the same host you installed the Moab Server.

Once you have determined which components are installed on which hosts, complete the rest of the instructions for the MAM installation.

> The instructions that follow in this topic will use the term Host after each component to reflect installing on a host (again, meaning the physical machine). For example, MAM Server Host and MAM Database Host. Depending on your configuration, Host may refer to as installed on its own machine or installed on the same machine as another component.

Open Necessary Ports

If your site is running firewall software on its hosts, you will need to configure the firewall to allow connections to the necessary ports.

Do the following as needed:

1. If you will be installing the MAM Server on a separate host than you installed the Moab Server *or* you will be installing the MAM Clients on other hosts, then on the MAM Server Host, open the MAM Server port (7112) in the firewall.

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod

[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
-A INPUT -p tcp --dport 7112 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod

[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=7112/tcp --permanent

[root]# firewall-cmd --reload
```

- SUSE 11-based and SUSE 12-based systems using SuSEfirewall2

```
[root]# vi /etc/sysconfig/SuSEfirewall2

FW_SERVICES_EXT_TCP="7112"

[root]# service SuSEfirewall2_setup restart
```

2. If using the MAM GUI, then on the MAM GUI Host, open the https port in the firewall for secure browser communication.

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod

[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
-A INPUT -p tcp --dport 443 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod

[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=https/tcp --permanent

[root]# firewall-cmd --reload
```

- SUSE 11-based and SUSE 12-based systems using SuSEfirewall2

```
[root]# vi /etc/sysconfig/SuSEfirewall2

FW_SERVICES_EXT_TCP="443"

[root]# service SuSEfirewall2_setup restart
```

3. If you are *not* installing the MAM Database on the same host you will install the MAM Server, then on the MAM Database Host, open the postgres port (5432) in the firewall.
   - Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod

[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
-A INPUT -p tcp --dport 5432 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod

[root]# service iptables save
```

   - Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=postgres/tcp --permanent

[root]# firewall-cmd --reload
```

   - SUSE 11-based and SUSE 12-based systems using SuSEfirewall2

```
[root]# vi /etc/sysconfig/SuSEfirewall2

FW_SERVICES_EXT_TCP="5432"

[root]# service SuSEfirewall2_setup restart
```

Install and Initialize the PostgreSQL Server

Moab Accounting Manager uses a database for transactions and data persistence. The PostgreSQL database may be installed on a separate host from the MAM Server; however, it is often convenient to install them on the same host.

On the MAM Database Host, do the following:

1. Install and initialize the PostreSQL Server.
   - Red Hat 6-based systems

```
[root]# yum install postgresql-server
[root]# service postgresql initdb
```

   - Red Hat 7-based systems

```
[root]# yum install postgresql-server
[root]# postgresql-setup initdb
```

   - SUSE 11-based or SUSE 12-based systems

```
[root]# zypper install postgresql-server
[root]# service postgresql start
```

2. Configure trusted connections.

   Edit or add a "host" line in the pg_hba.conf file for the interface from which the MAM Server will be connecting to the database and ensure that it specifies a secure password-based authentication method (for example, md5).

```
[root]# vi /var/lib/pgsql/data/pg_hba.conf

# Replace 127.0.0.1 with the IP address of the MAM Server Host if the
# MAM PostgreSQL server is on a separate host from the MAM server.
host    all             all             127.0.0.1/32            md5
host    all             all             ::1/128                 md5

---
```

3. If the MAM Database Host is installed on a *separate* host from where you will install the MAM Server, configure PostgreSQL to accept connections from the MAM Server Host.

```
[root]# vi /var/lib/pgsql/data/postgresql.conf

# Replace <mam-server-host> with the interface name from which the MAM server
# will be connecting to the database.
listen_addresses = '<mam-server-host>'

---
```

4. Start or restart the database.

   - Red Hat 6-based or SUSE 11-based systems

```
[root]# chkconfig postgresql on

[root]# service postgresql restart
```

   - Red Hat 7-based or SUSE 12-based systems

```
[root]# systemctl enable postgresql.service

[root]# systemctl restart postgresql.service
```

Install Dependencies, Packages, or Clients

Use the following instructions to install the required Moab Accounting Manager dependencies, packages, or clients.

Depending on your configuration, the MAM Server Host and the MAM GUI Host may be installed on the same host. The MAM Client Host is automatically installed on the same host as the MAM Server Host; however, you can also install the MAM Client Host on any other hosts on which you want to have the MAM client commands available to users or administrators.

1. On the MAM Server Host, the MAM GUI Host, and the MAM Client Hosts, do the following:
   - Red Hat-based systems

```
[root]# yum install gcc redhat-lsb-core perl rrdtool perl-Config-Tiny perl-
Crypt-CBC perl-Crypt-DES perl-Crypt-DES_EDE3 perl-Digest-HMAC perl-Error perl-
Log-Dispatch-FileRotate perl-Log-Log4perl perl-XML-LibXML
```

     If installing on RHEL 6.5, you might encounter failed dependencies on perl(Config::Tiny), perl(Email::Date::Format) and perl(RRDs).

     - One way to overcome this problem is to rerun the yum install command with the --skip-broken option and then install the failing dependencies from a reputable FTP site such as rpmfind.net or pbone.net. For example:

```
[root]# rpm -Uvh ftp://www.rpmfind.net/linux/centos/6/os/x86_
64/Packages/rrdtool-1.3.8-7.el6.x86_64.rpm
[root]# rpm -Uvh ftp://www.rpmfind.net/linux/centos/6/os/x86_
64/Packages/rrdtool-perl-1.3.8-7.el6.x86_64.rpm
[root]# rpm -Uvh ftp://www.rpmfind.net/linux/centos/6/os/x86_
64/Packages/perl-Email-Date-Format-1.002-5.el6.noarch.rpm
[root]# rpm -Uvh ftp://www.rpmfind.net/linux/centos/6/os/x86_
64/Packages/perl-Config-Tiny-2.12-7.1.el6.noarch.rpm
```

       When done, re-run the original `yum install` command.

     - *Alternatively*, you can install the missing modules from CPAN.

```
[root]# yum install perl-CPAN
[root]# cpan Config::Tiny Log::Log4perl Log::Dispatch::FileRotate
Compress::Zlib
```

       You may need to run the cpan command more than once for it to complete successfully.

   - SUSE-based systems

```
[root]# zypper install gcc lsb-release perl-Config-Tiny perl-Crypt-CBC perl-
Crypt-DES perl-Crypt-DES_EDE3 perl-Digest-HMAC perl-Error perl-Log-Log4perl
perl-XML-LibXML perl-Params-Validate perl-YAML perl-Log-Dispatch perl-Log-
Dispatch-FileRotate
```

2. On the MAM Server Host, do the following:
   - Red Hat 6-based and Red Hat 7-based systems

     ```
     [root]# yum install postgresql postgresql-libs perl-DBD-Pg perl-Date-Manip perl-
     Time-HiRes perl-DBI
     ```

   - SUSE 11-based systems

     ```
     [root]# zypper install postgresql postgresql-libs perl-DBD-Pg perl-Date-Manip
     perl-DBI
     ```

   - SUSE 12-based systems

     ```
     [root]# zypper install postgresql93 postgresql93-devel libpq5 perl-DBD-Pg perl-
     Date-Manip perl-DBI
     ```

3. On the MAM GUI Host, do the following:
   - Red Hat-based systems

     ```
     [root]# yum install httpd mod_ssl perl-CGI perl-CGI-Session
     ```

   - SUSE-based systems

     ```
     [root]# zypper install apache2 perl-CGI perl-CGI-Session
     ```

4. On each of the MAM Client Hosts (including the MAM Server Host), do the following:
   - Red Hat 6-based systems

     ```
     [root]# yum install perl-suidperl perl-Term-ReadLine-Gnu perl-TermReadKey
     ```

   - Red Hat 7-based systems

     ```
     [root]# yum install perl-CPAN openssl-devel readline-devel ncurses-devel perl-
     TermReadKey
     [root]# cpan Term::ReadLine::Gnu
     ```

   - SUSE 11-based systems

     ```
     [root]# zypper install libopenssl-devel perl-TermReadLine-Gnu perl-TermReadKey
     [root]# chmod 4755 /usr/bin/sperl*
     ```

   - SUSE 12-based systems

     ```
     [root]# zypper install libopenssl-devel perl-TermReadLine-Gnu perl-Term-ReadKey
     ```

If any of the Perl module packages fail to install or are unavailable for your system, you can install it from CPAN by running `cpan MODULENAME` where *MODULENAME* is the respective perl module name.

(Optional) Build a Custom RPM

Do the following:

1. Install `rpm-build`.

```
[root]# yum install rpm-build
```

2. Download the latest MAM build (`mam-<version>.tar.gz`) from the Adaptive Computing website.

> The variable marked <*version*> is the desired version of the suite; for example, 8.1.1.

3. Untar the downloaded package.
4. Change directories into the untarred directory.
5. Edit the `./mam.spec` file for RPM customization.
6. Run `./rpm-build`.
7. Locate the custom RPM in `rpm/RPMS/x86_64`.

Install MAM Server

On the MAM Server Host, do the following:

1. Create a user called `mam` and switch to that user.

```
[root]# useradd -m mam
[root]# su - mam
[mam]$ mkdir src
[mam]$ cd src
```

2. Download the latest MAM build (`mam-<version>.tar.gz`) from the Adaptive Computing website.

> The variable marked <*version*> is the desired version of the suite; for example, 8.1.1.

3. Untar the MAM tarball.

```
[mam]$ tar -zxvf mam-8.1.1.tar.gz
```

4. Navigate to `mam-8.1.1`.

```
[mam]$ cd mam-8.1.1
```

5. Configure the software. For a list of all the configuration options, see Moab Accounting Manager Configuration Options on page 60.

```
[mam]$ ./configure
```

6. Compile the software.

```
[mam]$ make
```

> If you only need to install the clients on a particular system, replace make with make clients-only. If you only need to install the web GUI on a particular system, replace make with make gui-only.

7. Install the software.

```
[mam]$ exit
[root]# cd ~mam/src/mam-8.1.1
[root]# make install
```

> If you only need to install the clients on a particular system, replace make install with make install-clients-only. If you only need to install the web GUI on a particular system, replace make install with make install-gui-only.

8. As the database user, create a database called `mam` and grant database privileges to the `mam` user.

> PostgreSQL should have previously been installed using the instructions in Install Dependencies, Packages, or Clients on page 29.

```
[root]# su - postgres
[postgres]$ psql

create database mam;
create user mam with password 'changeme!';
\q

[postgres]$ exit
```

The password you define must be synchronized with the `database.password` value in `/opt/mam/etc/goldd.conf`.

```
[root]# vi /opt/mam/etc/goldd.conf

database.password = changeme!
```

9. Run the `hpc.sql` script to populate the Moab Accounting Manager database with objects, actions, and attributes necessary to function as an Accounting Manager.

```
[root]# su - mam
[mam]$ cd src/mam-8.1.1
[mam]$ psql mam < hpc.sql
[mam]$ exit
```

10. Configure MAM to automatically start up at system boot; start the `mam` service.

- Red Hat 6-based or SUSE 11-based systems

```
[root]# chkconfig --add mam
[root]# service mam start
```

- Red Hat 7-based or SUSE 12-based systems

```
[root]# systemctl enable mam.service
[root]# systemctl start mam.service
```

Configure the MAM GUI

If you plan to use the web GUI, then on the MAM GUI Host, do the following:

1. As `root`, add or edit the SSL virtual host definition as appropriate for your environment. To do so, configure the `cgi-bin` directory in `ssl.conf`. Below the `cgi-bin` directory element, create an alias for `/cgi-bin` pointing to your `cgi-bin` directory. If you chose to install to a cgi-bin sub-directory, you might want to create an alias for that as well. Also, add `index.cgi` to the `DirectoryIndex` so you can use the shorter sub-directory name.

   - Red Hat 6-based and Red Hat 7-based systems

```
[root]# vi /etc/httpd/conf.d/ssl.conf

<Directory "/var/www/cgi-bin">
## Add these lines
  Options ExecCGI
  AddHandler cgi-script .cgi
  AllowOverride All
  Order allow,deny
  Allow from all
</Directory>

# Aliases for /cgi-bin
Alias /cgi-bin/ /var/www/cgi-bin/
Alias /mam /var/www/cgi-bin/mam/

# Make shorter sub-dir name available
DirectoryIndex index.cgi
```

   - SUSE 11-based systems

```
[root]# a2enflag SSL
[root]# cp /etc/apache2/vhosts.d/vhost-ssl.template /etc/apache2/vhosts.d/mam-
ssl.conf
[root]# vi /etc/apache2/vhosts.d/mam-ssl.conf

<Directory "/srv/www/cgi-bin">
## Add these lines
  Options ExecCGI
  AddHandler cgi-script .cgi
  AllowOverride All
  Order allow,deny
  Allow from all
</Directory>

# Aliases for /cgi-bin
Alias /cgi-bin/ /srv/www/cgi-bin/
Alias /mam /srv/www/cgi-bin/mam/

# Make shorter sub-dir name available
DirectoryIndex index.cgi
```

- SUSE 12-based systems

```
[root]# a2enflag SSL
[root]# cp /etc/apache2/vhosts.d/vhost-ssl.template /etc/apache2/vhosts.d/mam-
ssl.conf
[root]# vi /etc/apache2/vhosts.d/mam-ssl.conf

<Directory "/srv/www/cgi-bin">
    Options ExecCGI
    AddHandler cgi-script .cgi
    AllowOverride All
    Require all granted
</Directory>

# Aliases for /cgi-bin
Alias /cgi-bin/ /srv/www/cgi-bin/
Alias /mam /srv/www/cgi-bin/mam/

# Make shorter sub-dir name available
DirectoryIndex index.cgi
```

2. For Red Hat-based systems where Security Enhanced Linux (SELinux) is enforced, you may need to customize SELinux to allow the web server to make network connections, use `setuid` for authentication, and write to the log file.

   a. Determine the current mode of SELinux.

```
[root]# getenforce

Enforcing
```

   - If the command returns a mode of **Disabled** or **Permissive**, or if the `getenforce` command is not found, you can skip the rest of this step.
   - If the command returns a mode of **Enforcing**, you can choose between options of customizing SELinux to allow the web GUI to perform its required functions or disabling SELinux on your system.

b. If you choose to customize SELinux, do the following:

> SELinux can vary by version and architecture and that these instructions may not work in all possible environments.

> If you used the `--prefix=<prefix>` configuration option when you configured Moab Accounting Manager, you must replace references to `/opt/mam` in the example below with the <*prefix*> you specified. See Moab Accounting Manager Configuration Options on page 60.

- Red Hat 6-based systems

```
[root]# cat > mamgui.te <<EOF
module mamgui 1.0;
require {
        type httpd_sys_script_t;
        type port_t;
        class capability setuid;
        class tcp_socket name_connect;
}
allow httpd_sys_script_t port_t:tcp_socket name_connect;
allow httpd_sys_script_t self:capability setuid;
EOF
[root]# checkmodule -M -m -o mamgui.mod mamgui.te
[root]# semodule_package -m mamgui.mod -o mamgui.pp
[root]# semodule -i mamgui.pp
[root]# setenforce 0
[root]# chcon -v -t httpd_sys_content_t /opt/mam/log /opt/mam/log/goldg.log*
[root]# setenforce 1
```

- Red Hat 7-based systems

```
[root]# yum install yum install checkpolicy policycoreutils-python
[root]# cat > mamgui.te <<EOF
module mamgui 1.0;
require {
        type httpd_sys_script_t;
        type unreserved_port_t;
        class tcp_socket name_connect;
}
allow httpd_sys_script_t unreserved_port_t:tcp_socket name_connect;
EOF
[root]# checkmodule -M -m -o mamgui.mod mamgui.te
[root]# semodule_package -m mamgui.mod -o mamgui.pp
[root]# semodule -i mamgui.pp
[root]# setenforce 0
[root]# chcon -v -t httpd_sys_rw_content_t /opt/mam/log /opt/mam/log/mam-
goldg.log*
[root]# setenforce 1
```

3. For the highest security, it is recommended that you install a public key certificate that has been signed by a certificate authority. The exact steps to do this are specific to your distribution and the chosen certificate authority. An overview of this process for CentOS 7 is documented at https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/System_Administrators_Guide/ch-Web_Servers.html#s2-

apache-mod_ssl.

Alternatively, if your network domain can be secured from man-in-the-middle attacks, you could use a self-signed certificate. Often this does not require any additional steps since in many distributions, such as Red Hat, the Apache SSL configuration provides self-signed certificates by default.

If your configuration uses self-signed certificates, do the following:

- Red Hat-based systems

  No action required. RedHat ships with ready-made certificates.

- SUSE-based systems

```
[root]# cd /etc/apache2
[root]# openssl genrsa -out ssl.key/server.key 1024
[root]# openssl req -new -key ssl.key/server.key -x509 -out ssl.crt/server.crt
```

4. Start or restart the HTTP server daemon.

   - Red Hat 6-based systems

```
[root]# chkconfig httpd on
[root]# service httpd restart
```

   - Red Hat 7-based systems

```
[root]# systemctl enable httpd.service
[root]# systemctl restart httpd.service
```

   - SUSE 11-based systems

```
[root]# chkconfig apache2 on
[root]# service apache2 restart
```

   - SUSE 12-based systems

```
[root]# systemctl enable apache2.service
[root]# systemctl restart apache2.service
```

Access the MAM GUI

If you plan to use the web GUI, then on the MAM Server Host, do the following:

1. Create a password for the `mam` user to be used with the MAM Web GUI.

```
[root]# su - mam
[mam]$ gchpasswd
```

2. Verify the connection.

   a. Open a web browser and navigate to `https://<mam-server-host>/cgi-bin/mam`.

   b. Log in as the `mam` user with the password you set in step 1.

Configure Moab Workload Manager to use Moab Accounting Manager

Do the following, where applicable:

1. On the *Moab* Server Host, edit the Moab configuration file.

```
[root]# vi /opt/moab/etc/moab.cfg
AMCFG[mam] TYPE=MAM HOST=<mam_server_host>
```

   a. Uncomment the AMCFG lines and customize as needed. See Accounting, Charging and Allocation Management in the *Moab Workload Manager Administrator Guide*.

   b. If the Moab Server and the MAM Server are on the *same* host, set HOST to 'localhost'; otherwise, set HOST to the host name for the MAM Server (MAM Server Host).

2. If you installed the MAM Server on a *different* host from where the Moab Server is installed, inform Moab of the MAM secrete key.

   a. On the *MAM* Server Host, copy the auto-generated secret key from the `token.value` value in the `/opt/mam/etc/site.conf` file.

   b. On the *Moab* Server Host, add the secrete key to the `moab-private.cfg` file as the value of the CLIENTCFG KEY attribute.

```
[root]# vi /opt/moab/etc/moab-private.cfg

CLIENTCFG[AM:mam] KEY=<MAMSecretKey>
```

   c. Restart Moab.

   - Red Hat 6-based or SUSE 11-based systems

```
service moab restart
```

   - Red Hat 7-based or SUSE 12-based systems

```
systemctl restart moab.service
```

Initialize Moab Accounting Manager

You will need to initialize Moab Accounting Manager to function in the way that is most applicable to the needs of your site. See **Initial Setup** in the *Moab Accounting Manager Administrator Guide* to set up Moab Accounting Manager for your desired accounting mode.

Related Topics

Preparing for Manual Installation on page 12

Installing Moab Web Services

This topic contains instructions on how to install Moab Web Services (MWS).

In this topic:

Open Necessary Ports

Moab Web Services requires certain ports to be open for essential communication. For communication with the tomcat web server, the default port is 8080. For communication with the Mongo database, the default port is 27017.

If you have a firewall enabled, do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the MWS server for communication with the tomcat web server
-A INPUT -p tcp --dport 8080 -j ACCEPT

# Needed on the Mongo server if installed on a separate host from MWS
-A INPUT -p tcp --dport 27017 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=8080/tcp --permanent
[root]# firewall-cmd --add-port=27017/tcp --permanent
[root]# firewall-cmd --reload
```

- SUSE 11-based and SUSE 12-based systems using SuSEfirewall2

```
[root]# vi /etc/sysconfig/SuSEfirewall2

# Add the following ports to the FW_SERVICES_EXT_TCP parameter as required

# Needed on the MWS server for communication with the tomcat web server
FW_SERVICES_EXT_TCP="8080"

# Needed on the Mongo server if installed on a separate host from MWS
FW_SERVICES_EXT_TCP="27017"

[root]# service SuSEfirewall2_setup restart
```

Install Dependencies and Packages

Use the following commands to install the required Moab Web Services dependencies and packages.

Install Java

Install the Linux x64 RPM version of Oracle® Java® 7 Runtime Environment.

> Oracle Java 7 Runtime Environment is the recommended Java environment, but Oracle Java 6 is also supported. All other versions of Java, including OpenJDK/IcedTea, GNU Compiler for Java, and so on cannot run Moab Web Services.

> The Oracle® Java® download page has moved and requires a web-enabled workstation to accept the license agreement and download the software.

Do the following:

1. Download Java 7 on a web-enabled workstation.
   a. Open a web browser and connect to the Java downloads page (http://www.oracle.com/technetwork/java/javase/downloads/jre7-downloads-1880261.html).
   b. Select the radio button to accept the license agreement.
   c. Click the download link for the Linux x64 RPM file.
2. Copy the Java 7 RPM to the MWS server using scp, rsync, or any similar network copy utility.
3. On the MWS server, run the following to install Java 7:

```
[root]# rpm -Uh <RPMfilename>
```

Install Tomcat

- Red Hat 6-based and Red Hat 7-based systems

```
[root]# yum install tomcat
```

- SUSE 11-based systems

```
[root]# zypper ar --refresh -r
http://download.opensuse.org/evergreen/11.4/openSUSE:Evergreen:11.4.repo
[root]# zypper in tomcat6
[root]# zypper mr -d openSUSE_Evergreen_11.4
```

- SUSE-12 based systems

```
[root]# zypper install tomcat
```

Install MongoDB

To install and enable MongoDB, do the following:

1. Install MongoDB.
   - Red Hat 6-based and Red Hat 7-based systems

```
[root]# cat > /etc/yum.repos.d/mongodb.repo <<End-of-file
[mongodb]
name=MongoDB Repository
baseurl=http://downloads-distro.mongodb.org/repo/redhat/os/x86_64
gpgcheck=0
enabled=1
exclude=mongodb-org mongodb-org-server
End-of-file
[root]# yum install mongo-10gen-server
```

   - SUSE 11-based systems

```
[root]# zypper ar --refresh -r
http://download.opensuse.org/repositories/server:/database/SLE_11_
SP3/server:database.repo
[root]# zypper install mongodb
```

   - SUSE-12 based systems

```
[root]# zypper ar --refresh -r
http://download.opensuse.org/repositories/server:/database/SLE_
12/server:database.repo
[root]# zypper install mongodb
```

2. Start MongoDB

> There may be a short delay (approximately three minutes) for Mongo to start the first time.

   - Red Hat 6-based systems

```
[root]# chkconfig mongod on
[root]# service mongod start
```

- Red Hat 7-based systems

```
[root]# cat > /usr/lib/systemd/system/mongodb.service <<End-of-file
[Unit]
Description=High-performance, schema-free document-oriented database
After=syslog.target network.target

[Service]
Type=forking
User=mongod
Group=mongod
Environment=CONFIG=/etc/mongod.conf
Environment=OPTIONS=
EnvironmentFile=-/etc/sysconfig/mongod
ExecStart=/usr/bin/mongod -f \$CONFIG \$OPTIONS
PrivateTmp=true
LimitNOFILE=65536
TimeoutStartSec=180
StandardOutput=syslog
StandardError=syslog

[Install]
WantedBy=multi-user.target
End-of-file
[root]# rm -f /etc/init.d/mongod
[root]# systemctl enable mongodb.service
[root]# systemctl start mongodb.service
```

- SUSE 11-based systems

```
[root]# chkconfig mongodb on
[root]# service mongodb start
```

- SUSE 12-based systems

```
[root]# systemctl enable mongodb.service
[root]# systemctl start mongodb.service
```

3. Prepare the MongoDB database by doing the following:

   a. Add the required MongoDB users.

> The passwords used below (`secret1`, `secret2`, and `secret3`) are examples. Choose your own passwords for these users.

```
[root]# mongo
> use admin;
> db.addUser("admin_user", "secret1");
> db.auth ("admin_user", "secret1");

> use moab;
> db.addUser("moab_user", "secret2");
> db.addUser("mws_user", "secret3", true);

> use mws;
> db.addUser("mws_user", "secret3");
> exit
```

> Because the `admin_user` has read and write rights to the `admin` database, it also has read and write rights to all other databases. See Control Access to MongoDB Instances with Authentication (at http://docs.mongodb.org/manual/tutorial/control-access-to-mongodb-with-authentication) for more information.

d. Enable authentication in MongoDB.

- Red Hat 6-based systems

```
[root]# vi /etc/mongod.conf
auth = true
[root]# service mongod restart
```

- Red Hat 7-based systems

```
[root]# vi /etc/mongod.conf
auth = true
[root]# systemctl restart mongodb.service
```

- SUSE 11-based and SUSE 12-based systems

  MongoDB authentication is enabled (`auth = true`) by default. No further action is needed.

Install Moab Web Services

> You must deploy Moab Web Services on the same server as Moab Workload Manager.

1. Verify Moab is installed and configured as desired. See Installing Moab Workload Manager on page 20.
2. Start Moab.
   - Red Hat 6-based and SUSE 11-based systems
     ```
     [root]# service moab start
     ```
   - Red Hat 7-based and SUSE 12-based systems
     ```
     [root]# systemctl start moab.service
     ```
3. Create the MWS home directory and subdirectories. See **Configuration** in the *Moab Web Services Reference Guide*.

   > The default location for the MWS home directory is `/opt/mws`. These instructions assume the default location.

   Here is a sample script for this setup:

```
[root]# mkdir -p \
    /opt/mws/etc/mws.d \
    /opt/mws/hooks \
    /opt/mws/log \
    /opt/mws/plugins \
    /opt/mws/spool/hooks \
    /opt/mws/utils
[root]# chown -R tomcat:tomcat /opt/mws
[root]# chmod -R 555 /opt/mws
[root]# chmod u+w \
    /opt/mws/log \
    /opt/mws/plugins \
    /opt/mws/spool \
    /opt/mws/spool/hooks \
    /opt/mws/utils
```

4. Download the latest MWS build (`mws-<version>.tar.gz`) from the Adaptive Computing website.

   The variable marked <*version*> is the desired version of the suite; for example, 8.1.1.

5. Extract the contents of the MWS download tarball into a temporary directory. For example:

```
[root]# mkdir /tmp/mws-install
[root]# cd /tmp/mws-install
[root]# tar xvzf $HOME/Downloads/mws-8.1.1.tar.gz
```

6. Copy the extracted utility files to the utility directory created above and give the tomcat user ownership of the directory.

```
[root]# cd /tmp/mws-install/mws-8.1.1/utils
[root]# cp * /opt/mws/utils
[root]# chown tomcat:tomcat /opt/mws/utils/*
```

7. Connect Moab to MongoDB.

   On the Moab head node, connect Moab to MongoDB.

   The USEDATABASE parameter is unrelated to the MongoDB configuration.

   a. Set the **MONGOSERVER** parameter in /opt/moab/etc/moab.cfg to the MongoDB server hostname. Use localhost as the hostname if Moab and MongoDB are hosted on the same server.

```
MONGOSERVER <host>[:<port>]
```

      If your **MONGOSERVER** host is set to anything other than localhost, edit the /etc/mongod.conf file on the MongoDB server host and either comment out any bind_ip parameter or set it to the correct IP address:

```
# Listen to local interface only. Comment out to listen on all interfaces.
#bind_ip=127.0.0.1
```

b. In the /opt/moab/etc/moab-private.cfg file, set the **MONGOUSER** and **MONGOPASSWORD** parameters to the MongoDB moab_user credentials you set. See Install MongoDB in the Dependencies and Packages Installation section earlier in this topic.

```
MONGOUSER     moab_user
MONGOPASSWORD secret2
```

c. Verify that Moab is able to connect to MongoDB.

- Red Hat 6-based and SUSE 11-based systems

```
[root]# service moab restart
[root]# mdiag -S
...
Mongo connection (localhost) is up (credentials are set)
...
```

- Red Hat 7-based and SUSE 12-based systems

```
[root]# systemctl restart moab.service
[root]# mdiag -S
...
Mongo connection (localhost) is up (credentials are set)
...
```

8. Secure communication using secret keys.

a. (Required) Moab and MWS use Message Authentication Codes (MAC) to ensure messages have not been altered or corrupted in transit. On the Moab head node, generate a key and store the result in /opt/moab/etc/.moab.key.

- Red Hat 6-based and SUSE 11-based systems

```
[root]# service moab stop
[root]# dd if=/dev/urandom count=18 bs=1 2>/dev/null | base64 >
/opt/moab/etc/.moab.key
[root]# chown root:root /opt/moab/etc/.moab.key
[root]# chmod 400 /opt/moab/etc/.moab.key
[root]# service moab start
```

- Red Hat 7-based and SUSE 12-based systems

```
[root]# systemctl stop moab.service
[root]# dd if=/dev/urandom count=18 bs=1 2>/dev/null | base64 >
/opt/moab/etc/.moab.key
[root]# chown root:root /opt/moab/etc/.moab.key
[root]# chmod 400 /opt/moab/etc/.moab.key
[root]# systemctl start moab.service
```

The key you specify in the `.moab.key` file is the same key you must also specify in the `moab.secretKey` property when installing and configuring MWS in the next step.

b. (Optional) Moab supports message queue security using AES. This feature requires a Base64-encoded 16-byte (128-bit) shared secret. On the Moab head node, generate a key and append the result to `/opt/moab/etc/moab-private.cfg`.

- Red Hat 6-based and SUSE 11-based systems

```
[root]# service moab stop
[root]# echo "MESSAGEQUEUESECRETKEY $(dd if=/dev/urandom count=16 bs=1
2>/dev/null | base64)" >> /opt/moab/etc/moab-private.cfg
[root]# service moab start
```

- Red Hat 7-based and SUSE 12-based systems

```
[root]# systemctl stop moab.service
[root]# echo "MESSAGEQUEUESECRETKEY $(dd if=/dev/urandom count=16 bs=1
2>/dev/null | base64)" >> /opt/moab/etc/moab-private.cfg
[root]# systemctl start moab.service
```

The key you specify in the moab-private.cfg file is the same key you must also specify in the moab.messageQueue.secretKey property when installing and configuring MWS in the next step.

> If MWS is configured to encrypt the message queue and Moab is not (or vice versa), then MWS will ignore the messsages from Moab. Furthermore, all attempts to access the MWS service resource will fail.

c. (Optional) Verify that encryption is on for the ZeroMQ connection.

```
[root]# mdiag -S|grep 'ZeroMQ MWS'
 ZeroMQ MWS connection is bound on port 5570 (encryption is on)
```

9. Set up the MWS configuration files. In the extracted directory are several configuration files.

a. Copy the configuration files into place and grant the tomcat user read access.

```
[root]# cd /tmp/mws-install/mws-8.1.1
[root]# cp mws-config.groovy /opt/mws/etc
[root]# cp mws-config-hpc.groovy /opt/mws/etc/mws.d
[root]# chown tomcat:tomcat /opt/mws/etc/mws-config.groovy
/opt/mws/etc/mws.d/mws-config-hpc.groovy
[root]# chmod 400 /opt/mws/etc/mws-config.groovy /opt/mws/etc/mws.d/mws-config-
hpc.groovy
```

b. In the `/opt/mws/etc/mws-config.groovy` file, change these settings:

- **moab.secretKey**: Must match the Moab secret key you generated earlier (contained in `/opt/moab/etc/.moab.key`).
- **auth.defaultUser.username**: Any value you like, or leave as is.

- **auth.defaultUser.password**: Any value you like, but choose a strong password.
- **moab.messageQueue.secretKey**: If you opted to configure a message queue security key in MWS, this parameter value should match exactly that key specified in `/opt/moab/etc/moab-private.cfg` for the MESSAGEQUEUESECRETKEY Moab configuration parameter on the Moab head node in the previous step..

> **Important:** If MWS is configured to encrypt the message queue and Moab is not (or vice versa), then the messages from Moab will be ignored. Furthermore, all attempts to access the MWS service resource will fail.

```
[root]# vi /opt/mws/etc/mws-config.groovy

// Replace <ENTER-KEY-HERE> with the contents of /opt/moab/etc/.moab.key.

moab.secretKey = "<ENTER-KEY-HERE>"
moab.server = "localhost"
moab.port = 42559

// Replace <ENTER-KEY-HERE> with the value of MESSAGEQUEUESECRETKEY in
/opt/moab/etc/moab-private.cfg.

moab.messageQueue.secretKey = "<ENTER-KEY-HERE>"

// Change these to be whatever you like.

auth.defaultUser.username = "moab-admin"
auth.defaultUser.password = "changeme!"
```

> **Warning:** If you do not change **auth.defaultUser.password**, your MWS will not be secure (because anyone reading these instructions would be able to log into your MWS). Here are some tips for choosing a good password.

c. If you are using Moab Accounting Manager, change these settings in `/opt/mws/etc/mws.d/mws-config-hpc.groovy`:

- **mam.secretKey**: needs to match the MAM secret key in `/opt/mam/etc/site.conf` on the MAM head node (as **token.value**)
- **mam.server**: set to the hostname of the MAM server
- **mam.port**: set to the port of the MAM server

```
[root]# vi /opt/mws/etc/mws.d/mws-config-hpc.groovy

mam.secretKey = "<ENTER-KEY-HERE>"
mam.server = "localhost"
mam.port = 7112
```

d. Do *one* of the following:

> You can configure only one authentication method in `mws-config.groovy`—LDAP or PAM, but not both. If you have configured both LDAP and PAM, MWS defaults to using LDAP.
>
> If you need multiple authentication methods, you must add them to your local PAM configuration. See your distribution documentation for details.

- If you are configuring an MWS connection to your LDAP server, add the following parameters to `/opt/mws/etc/mws-config.groovy`:

```
ldap.server  = "192.168.0.5"
ldap.port = 389
ldap.baseDNs = ["dc=acme,dc=com"]
ldap.bindUser = "cn=Manager,dc=acme,dc=com"
ldap.password = "*****"
ldap.directory.type = "OpenLDAP Using InetOrgPerson Schema"
```

This is just an example LDAP connection. Be sure to use the appropriate domain controllers (dc) and common names (cn) for your environment.

> If you followed the Adaptive Computing tutorial, Setting Up OpenLDAP on CentOS 6 on page 106, your **ldap.directory.type** should be set to "OpenLDAP Using InetOrgPerson Schema." However, the use of other schemas is supported. See **LDAP Configuration Using mws-config.groovy** in the *Moab Web Services Reference Guide*.

> To see how to configure a secure connection to the LDAP server, see **Securing the LDAP Connection** in the *Moab Web Services Reference Guide*.

- If you are configuring MWS to use PAM, add the the **pam.configuration.service** parameter to the `mws-config.groovy` file. For example:

```
pam.configuration.service = "login"
```

> For more information about PAM configuration with MWS, see **PAM (Pluggable Authentication Module) Configuration Using mws-config.groovy** in the *Moab Web Services Reference Guide*.

> There is a security risk when authenticating local users through your PAM configuration. This behavior is highly discouraged and not supported by Adaptive Computing.

e. Add the **grails.mongo.username** and **grails.mongo.password** parameters to the `mws-config.groovy` file. Use the MWS credentials you added to MongoDB in the Preparing for Manual Installation on page 12.

```
...
grails.mongo.username = "mws_user"
grails.mongo.password = "secret3"
```

10. Configure Tomcat

- Red Hat 6-based and Red Hat 7-based systems

  Add the following lines to the end of `/etc/tomcat/tomcat.conf`.

```
CATALINA_OPTS="-DMWS_HOME=/opt/mws -Xms256m -Xmx3g -XX:MaxPermSize=384m -
Dfile.encoding=UTF8"
JAVA_HOME="/usr/java/latest"
```

- SUSE 11-based systems

  Add the following lines to the end of `/etc/tomcat6/tomcat6.conf`.

```
CATALINA_OPTS="-DMWS_HOME=/opt/mws -Xms256m -Xmx3g -XX:MaxPermSize=384m -
Dfile.encoding=UTF8"
JAVA_HOME="/usr/java/latest"
```

- SUSE 12-based systems

  Add the following lines to the end of `/etc/tomcat/tomcat.conf`.

```
CATALINA_OPTS="-DMWS_HOME=/opt/mws -Xms256m -Xmx3g -XX:MaxPermSize=384m -
Dfile.encoding=UTF8"
JAVA_HOME="/usr/java/latest"
```

11. Deploy the `mws.war` file and start Tomcat.

- Red Hat 6-based systems

```
[root]# chkconfig tomcat on
[root]# service tomcat stop
[root]# cp /tmp/mws-install/mws-8.1.1/mws.war /usr/share/tomcat/webapps
[root]# service tomcat start
```

- SUSE 11-based systems

```
[root]# chkconfig tomcat6 on
[root]# service tomcat6 stop
[root]# cp /tmp/mws-install/mws-8.1.1/mws.war /usr/share/tomcat6/webapps
[root]# service tomcat6 start
```

- Red Hat 7-based and SUSE 12-based systems

```
[root]# systemctl enable tomcat.service
[root]# systemctl stop tomcat.service
[root]# cp /tmp/mws-install/mws-8.1.1/mws.war /usr/share/tomcat/webapps
[root]# systemctl start tomcat.service
```

12. Navigate to `http://<localhost>:8080/mws/` in a web browser to verify that MWS is running (you will see some sample queries and a few other actions).
13. Log in to MWS to verify that your credentials are working. (Your login credentials are the `auth.defaultUser.username` and `auth.defaultUser.password` values you set in the `/opt/mws/etc/mws-config.groovy` file.)

If you encounter problems, or if the application does not seem to be running, see the steps in Moab Web Services Issues on page 139.

Additional Configuration

In this section:

Configuring SSL in Tomcat

To configure SSL in Tomcat, please refer to the Apache Tomcat documentation.

Setting Up OpenLDAP on CentOS 6

These instructions are intended to help first-time LDAP administrators get up and running. The following procedures contain instructions for getting started using OpenLDAP on a CentOS 6 system. For more complete information on how to set up OpenLDAP see the OpenLDAP documentation (http://www.openldap.org/doc/admin24/).

In this topic:

Adaptive Computing is not responsible for creating, maintaining, or supporting customer LDAP or Active Directory configurations.

Installing and Configuring OpenLDAP on Centos 6

First, you will need to install OpenLDAP. These instructions explain how you can do this on a CentOS 6 system.

To install and configure OpenLDAP on Centos 6

1. Run the following command:

```
[root]# yum -y install openldap openldap-clients openldap-servers
```

2. Generate a password hash to be used as the admin password. This password hash will be used when you create the root user for your LDAP installation. For example:

```
[root]# slappasswd
New password : p@ssw0rd
Re-enter new password : p@ssw0rd
{SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
```

3. Add the root user and the root user's password hash to the OpenLDAP configuration in the `olcDatabase={2}bdb.ldif` file. The root user will have permissions to add other users, groups, organizational units, etc. Do the following:

   a. Run this command:

```
[root]# cd /etc/openldap/slapd.d/cn\=config
[root]# vi olcDatabase\=\{2\}bdb.ldif
```

   b. If the **olcRootPW** attribute does not already exist, create it. Then set the value to be the hash you created from `slappasswd`. For example:

```
olcRootPW: {SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
...
```

4. While editing this file, change the distinguished name (DN) of the **olcSuffix** to something appropriate. The suffix typically corresponds to your DNS domain name, and it will be appended to the DN of every other LDAP entry in your LDAP tree.

   For example, let's say your company is called Acme Corporation, and that your domain name is "acme.com." You might make the following changes to the `olcDatabase={2}bdb.ldif` file:

```
olcSuffix: dc=acme,dc=com
...
olcRootDN: cn=Manager,dc=acme,dc=com
...
olcRootPW: {SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
...
```

> Throughout the following examples in this topic, you will see `dc=acme,dc=com`. "acme" is only used as an example to illustrate what you would use as your own domain controller if your domain name was "acme.com." You should replace any references to "acme" with your own organization's domain name.

> **Do not set the cn of your root user to "root" (`cn=root,dc=acme,dc=com`), or OpenLDAP will have problems.**

5. Modify the DN of the root user in the `olcDatabase={1}monitor.ldif` file to match the **olcRootDN** line in the `olcDatabase={2}bdb.ldif` file. Do the following:

   a. Run this command to edit the `olcDatabase={2}bdb.ldif` file:

   ```
   [root]# vi olcDatabase\={1\}monitor.ldif
   ```

   b. Modify the **olcAccess** line so that the **dn.base** matches the **olcRootDN** from the `olcDatabase={2}bdb.ldif` file. (In this example, **dn.base** should be "cn=Manager,dc=acme,dc=com".)

   ```
   olcAccess: {0}to * by
   dn.base="gidNumber=0+uidNumber=0,cn=peercred,cn=external,cn=auth" read by
   dn.base="cn=Manager,dc=acme,dc=com" read by * none
   ```

   c. Now the root user for your LDAP is `cn=Manager,dc=acme,dc=com`. The root user's password is the password that you entered using `slappasswd` (see step 2), which, in this example, is **p@ssw0rd**

6. Hide the password hashes from users who should not have permission to view them.

> A full discussion on configuring access control in OpenLDAP is beyond the scope of this tutorial. For help, see the OpenLDAP Access Control documentation (http://www.openldap.org/doc/admin24/access-control.html).

   a. Run this command to edit the `oclDatabase\=\{2\}bdb.ldif` file:

   ```
   [root]# vi olcDatabase\=\{2\}bdb.ldif
   ```

   b. Add the following two lines to the end of the file to restrict users from viewing other users' password hashes.

   ```
   olcAccess: {0}to attrs=userPassword by self write by
   dn.base="cn=Manager,dc=acme,dc=com" write by anonymous auth by * none
   olcAccess: {1}to * by dn.base="cn=Manager,dc=acme,dc=com" write by self write by
   * read
   ```

   These lines allow a user to read and write his or her own password. It also allows a manager to read and write anyone's password. Anyone, including anonymous users, is allowed to view non-password attributes of other users.

7. Make sure that OpenLDAP is configured to start when the machine starts up, and start the OpenLDAP service.

```
[root]# chkconfig slapd on
[root]# service slapd start
```

8. Now, you must manually create the "dc=acme,dc=com" LDAP entry in your LDAP tree.

   An LDAP directory is analogous to a tree. Nodes in this tree are called LDAP "entries" and may represent users, groups, organizational units, domain controllers, or other objects. The attributes in each entry are determined by the LDAP schema. In this tutorial we will build entries based on the InetOrgPerson schema (which ships with OpenLDAP by default).

   In order to build our LDAP tree we must first create the root entry. Root entries are usually a special type of entry called a domain controller (DC). Because we are assuming that the organization is called Acme Corporation, and that the domain is "acme.com," we will create a domain controller LDAP entry called `dc=acme,dc=com`. Again, you will need to replace "acme" with your organization's domain name. Also note that `dc=acme,dc=com` is what is called an LDAP distinguished name (DN). An LDAP distinguished name uniquely identifies an LDAP entry.

   Do the following:

   a. Create a file called `acme.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

   ```
   [root]# cd /tmp
   [root]# vi acme.ldif
   ```

   b. Add the following lines in `acme.ldif`:

   ```
   dn: dc=acme,dc=com
   objectClass: dcObject
   objectClass: organization
   dc: acme
   o : acme
   ```

   c. Now add the contents of this file to LDAP. Run this command:

   ```
   [root]# ldapadd -f acme.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
   ```

   d. Verify that your entry was added correctly.

   ```
   [root]# ldapsearch -x -LLL -b dc=acme,dc=com
   dn: dc=acme,dc=com
   objectClass: dcObject
   objectClass: organization
   dc: acme
   o: acme
   ```

9. Run the following:

   ```
   [root]# sudo iptables -L
   [root]# sudo service iptables save
   ```

10. By default, the CentOS 6 firewall will block external requests to OpenLDAP. In order to allow MWS to access LDAP, you will have to configure your firewall to allow connections on port 389. (Port 389 is the default LDAP port.)

    Configuring your firewall is beyond the scope of this tutorial; however, it may be helpful to know that the default firewall on CentOS is a service called `iptables`. (For more information, see the documentation on iptables.) In the most basic case, you may be able to add a rule to your firewall that accepts connections to port 389 by doing the following:

    a. Edit your `iptables` file:

    ```
    [root]# vi /etc/sysconfig/iptables
    ```

    b. Add the following line *after* all the **ACCEPT** lines but *before* any of the **REJECT** lines in your `iptables` file:

    ```
    # ... lines with ACCEPT should be above
    -A INPUT -p tcp --dport 389 -j ACCEPT
    # .. lines with REJECT should be below
    ```

    For example, here is a sample `iptables` file with this line added:

    ```
    *filter
    :INPUT ACCEPT [0:0]
    :FORWARD ACCEPT [0:0]
    :OUTPUT ACCEPT [0:0]
    -A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
    -A INPUT -p icmp -j ACCEPT
    -A INPUT -i lo -j ACCEPT
    -A INPUT -m state --state NEW -m tcp -p tcp --dport 22 -j ACCEPT
    -A INPUT -p tcp --dport 389 -j ACCEPT
    -A INPUT -j REJECT --reject-with icmp-host-prohibited
    -A FORWARD -j REJECT --reject-with icmp-host-prohibited

    COMMIT
    ```

    c. Now reload `iptables`.

    ```
    [root]# service iptables reload
    ```

    Although providing instructions is beyond the scope of this tutorial, it is also highly recommended that you set up OpenLDAP to use SSL or TLS security to prevent passwords and other sensitive data from being sent in plain text. For information on how to do this, see the OpenLDAP TLS documentation (http://www.openldap.org/doc/admin24/tls.html).

Now that you have installed and set up Open LDAP, you are ready to add organizational units. See Adding an Organizational Unit (OU) on page 55.

Adding an Organizational Unit (OU)

These instructions will describe how to populate the LDAP tree with organizational units (OUs), groups, and users, all of which are different types of LDAP entries. The examples that follow also presume an InetOrgPerson schema, because the InetOrgPerson schema is delivered with OpenLDAP by default.

To add an organizational unit (OU) entry to the LDAP tree

In this example, we are going to add an OU called "Users."

1. Create a temporary file called `users.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi users.ldif
```

2. Add these lines to `users.ldif`:

```
dn: ou=Users,dc=acme,dc=com
objectClass: organizationalUnit
ou: Users
```

3. Add the contents of `users.ldif` file to LDAP.

```
[root]# ldapadd -f users.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a User

To add a user to LDAP

In this example, we will add a user named "Bob Jones" to LDAP inside the "Users" OU.

1. Create a temporary file called `bob.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi bob.ldif
```

2. Add these lines to `bob.ldif`:

```
dn: cn=Bob Jones,ou=Users,dc=acme,dc=com
cn: Bob Jones
sn: Jones
objectClass: inetOrgPerson
userPassword: p@ssw0rd
uid: bjones
```

3. Add the contents of `bob.ldif` file to LDAP.

```
[root]# ldapadd -f bob.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a Group

To add a group to LDAP

In this example, we will add a group called "Engineering" to LDAP inside the "Users" OU.

1. Create a temporary file called `engineering.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi engineering.ldif
```

2. Add these lines to `engineering.ldif`:

```
dn: cn=Engineering,ou=Users,dc=acme,dc=com
cn: Engineering
objectClass: groupOfNames
member: cn=Bob Jones,ou=Users,dc=acme,dc=com
```

3. Add the contents of `engineering.ldif` file to LDAP.

```
[root]# ldapadd -f engineering.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a User to a Group

To add a user to an LDAP group

In this example, we will add an LDAP member named "Al Smith" to the "Engineering" LDAP group. This example assumes that user, Al Smith, has already been added to LDAP.

> Before you add a user to an LDAP group, the user must first be added to LDAP. For more information, see Adding a User on page 56.

1. Create a temporary file called `addUserToGroup.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi addUserToGroup.ldif
```

2. Add these lines to `addUserToGroup.ldif`:

```
dn: cn=Engineering,ou=Users,dc=acme,dc=com
changetype: modify
add: member
member: cn=Al Smith,ou=Users,dc=acme,dc=com
```

3. Now add the contents of `addUserToGroup.ldif` file to LDAP.

```
[root]# ldapadd -f addUserToGroup.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Moab Workload Manager Configuration Options

The following is a list of commonly used configure options. For a complete list, use ./configure --help when configuring Moab.

Option	Description	Example
--with-flexlm	Causes Moab to install the `license.mon.flexLM.pl` script in the `/opt/moab/tools` directory. See **Interfacing to FLEXlm** in the *Moab Workload Manager Administrator Guide* for more information about this script.	`[root]# ./configure --with-flexlm`
--with-homedir	Specifies the location of the Moab configuration directory and the MOABHOMEDIR environment variable. The default location is `/opt/moab`. MOABHOMEDIR is automatically set on some distributions during installation, when the --with-profile option is enabled.	`[root]# ./configure --with-homedir=/var/moab` *The Moab HPC Suite home directory will be `/var/moab` instead of the default `/opt/moab`.*

Option	Description	Example
--with-init	Enables the installation of a distribution-specific `/etc/init.d/moab` service startup script. This option is required if you want to install this script onto a new system. If you do not set this option, you must manually set up the Moab daemon service. The startup script is located at `OS/EL/etc/init.d/moab`. The TORQUE and Moab HPC Suite initialization scripts are provided in the `contrib/init.d` directory as a courtesy and may be modified at your discretion to work on your system.	`[root]# ./configure --with-init`
--prefix	Specifies the location of the binaries and libraries of the Moab install. The default location is `/opt/moab`.	`[root]# ./configure --prefix=/usr/local`
--with-profile	Enables the installation of distribution-specific `/etc/profile.d/moab.[c]sh` setup script for bash and cshell. The MOABHOMEDIR, PERL5LIB, PATH and MANPATH environment variables are setup to specify where the new moab configuration, scripts, binaries and man pages reside. If you do not set this option, these scripts are not installed, and you must manually perform this set up. The environment setup scripts are located at `OS/EL/etc/profile.d/moab.[c]sh`.	`[root]# ./configure --with-profile`

Option	Description	Example
--with-am	Specifies that you want to configure Moab with Moab Accounting Manager. There is a similar `--with-torque` option that configures Moab with TORQUE, but you do not need to specify this option if you install the "torque" tarball version.	`[root]# ./configure --with-am`

Moab Accounting Manager Configuration Options

The following table comprises commonly-used configure options.

Option	Description
-h,--help	Run `./configure --help` to see the list of configure options.
--prefix=PREFIX	Base installation directory where all subdirectories will be installed unless otherwise designated (defaults to `/opt/mam`).
--localstatedir=DIR	Home directory where per-configuration subdirectories (such as `etc`, `log`, `data`) will be installed (defaults to `PREFIX`).
--with-db-name=NAME	Name of the SQL database that the server will sync with (defaults to `mam`).
--with-user=USER	Use `--with-user` to specify the accounting admin userid that the server will run under and who will have full administrative privileges (defaults to the user running the configure command). It is recommended that this be a non-privileged user for the highest security.
--with-promotion=gauth|suidperl	Command-line clients and scripts using the API need to use a security promotion method to authenticate and encrypt the communication using the symmetric key. The default is `suidperl` if it is installed on the system, otherwise the default is `gauth`. See the description for the **security.promotion** configuration parameter in the **Client Configuration** in the *Moab Accounting Manager Administrator Guide* for more information about the two security promotion methods.

Option	Description
--with-gold-libs=local|site	Use `--with-gold-libs` to indicate whether you want to install the Gold modules in a local gold directory (`${exec_prefix}/lib`) or in the default system site-perl directory (defaults to `local`).
--with-cgi-bin=DIR	If you intend to use the web GUI, use `--with-cgi-bin` to specify the directory where you want the Moab Accounting Manager CGI files to reside (defaults to `/var/www/cgi-bin/mam`).
--with[out]-gui=SKIN	Specifies whether to install the CGI web GUI. If you do not intend to use the CGI web GUI, you can specify `--without-gui` to not install the CGI scripts. Otherwise, the default is to install the GUI CGI scripts.
--without-init	If you do not intend to use the mam `init.d` service, you can use `--without-init` to specify that Moab HPC Suite should not install the mam `init.d` script. Otherwise, the script is installed by default.
--without-profile	If you do not intend to use the mam `profile.d` environment scripts, you can use `--without-profile` to specify that Moab HPC Suite should not install the mam `profile.d` scripts. Otherwise, the scripts are installed by default.
--with-sha=SHA|SHA1	Allows you to override the auto-detected SHA Digest Perl (whether Digest::SHA1 or Digest::SHA) that should be used for your system.

Trusting Servers in Java

Prerequisites

Some of these instructions refer to `JAVA_HOME`, which must point to the same directory that Tomcat uses. To set `JAVA_HOME`, do this:

```
[root]# source /etc/tomcat6/tomcat6.conf
```

Your system administrator might have defined Tomcat's `JAVA_HOME` in a different file.

Retrieve the Server's X.509 Public Certificate

To retrieve the server's certificate, use the following command:

```
[root]# $JAVA_HOME/bin/keytool -printcert -rfc -sslserver <servername>:<port> >
/tmp/public.cert.pem
```

Replace <*servername*> with the server's host name and <*port*> with the secure port number. The default port for https is 443. The default port for ldaps is 636. If successful, `/tmp/public.cert.pem` contains the server's public certificate. Otherwise, `/tmp/public.cert.pem` contains an error message. This message is typical: `keytool error: java.lang.Exception: No certificate from the SSL server`. This message suggests that the server name or port is incorrect. Consult your IT department to determine the correct server name and port.

Add the Server's Certificate to Java's Keystore

Java stores trusted certificates in a database known as the keystore. Because each new version of Java has its own keystore, you need to add the server certificate to the Java keystore (using the steps below) every time you install a new version of Java.

Java's keystore is located at `$JAVA_HOME/lib/security/cacerts`. If Tomcat's `JAVA_HOME` points to a JDK, then the keystore is located at `$JAVA_HOME/jre/lib/security/cacerts`. To add the server certificate to the keystore, run the following command:

```
[root]# $JAVA_HOME/bin/keytool -import -trustcacerts -file /tmp/public.cert.pem -alias
<servername> -keystore $JAVA_HOME/lib/security/cacerts
```

You will be prompted for the keystore password, which is "changeit" by default.

> Your system administrator might have changed this password.

After you've entered the keystore password, you'll see the description of the server's certificate. At the end of the description it prompts you to trust the certificate.

```
Trust this certificate? [no]:
```

Type `yes` and press **Enter** to add the certificate to the keystore.

Upgrade

In this section:

Preparing for Upgrade

The upgrade process of the Moab HPC Suite includes upgrading the database and separate components in the suite. This guide contains detailed instructions for upgrading each component.

It is highly recommended that you *first* perform upgrades in a *test environment*. Installation and upgrade procedures are tested prior to release; however, due to customizable variations that may be utilized by your configuration, it is not recommended to drop new versions of software directly into production environments. This is especially true when the workload has vital bearing. Contact Adaptive Computing Professional Services for more information.

Because many system-level files and directories are accessed during the upgrade, the upgrade instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

Upgrade the Moab HPC Suite in the following order:

1. Mongo database. See Upgrading MongoDB on page 64
2. TORQUE. See Upgrading TORQUE on page 65
3. Moab Workload Manager. See Upgrading Moab Workload Manager on page 68

4. Moab Accounting Manager. See Upgrading Moab Accounting Manager on page 71
5. Moab Web Services. See Upgrading MWS on page 74

Related Topics

- Requirements on page 3

Upgrading MongoDB

Adaptive Computing recommends MongoDB version 2.4.x.

When upgrading, you must add 'exclude=mongodb-org mongodb-org-server' to the /etc/yum.repos.d/10gen.repo file to maintain 2.4.x:

```
[10gen]
name=MongoDB Repository
baseurl=http://downloads-distro.mongodb.org/repo/redhat/os/x86_64/
gpgcheck=0
enabled=1
exclude=mongodb-org mongodb-org-server
```

Upgrading from MongoDB Version 2.0

Support for environments using MongoDB 2.0 is now deprecated and will be removed in a future release.

1. Verify you can connect to the Mongo database.
   a. Obtain the Mongo username and password.

   ```
   [root]# grep grails.mongo /opt/mws/etc/mws-config.groovy
   grails.mongo.username = "mws_user"
   grails.mongo.password = "secret3"
   ```

   b. Using the Mongo username and password (in our example, username is "mws_user" and pasword is "secret3"), confirm you can log in.

   ```
   [root]# service mongod start
   [root]# mongo -u mws_user -p secret3 mws
   MongoDB shell version: 2.4.12
   connecting to: mws
   > show collections
   event
   mongeez
   pluginInstance
   ...
   ```

2. Refer to docs.mongodb.org for instructions on how to upgrade MongoDB. Note that you must pay close attention to the information regarding instances with auth enabled (as this is the recommended setup for Moab HPC Suite).

3. Remove version 2.0 and install 2.4

```
[root]# service mongod stop
[root]# yum remove mongo20-10gen-server mongo20-10gen
[root}# yum install mongo-10gen-server
[root]# service mongod start
```

Note that the settings in the `/etc/mongod.conf` file were saved in `/etc/mongod.conf.rpmsave` while removing MongoDB 2.0. You may need to be restore any custom settings after MongoDB 2.4.x is installed in the new `/etc/mongod.conf` file (for example, "auth = true").

4. After upgrading from 2.0 to 2.4.x, you should verify that the MongoDB credentials were preserved. Refer to step 1.

Upgrading TORQUE

TORQUE 5.1.1 binaries are backward compatible with TORQUE 5.0.x. However they are not backward compatible with TORQUE versions prior to 5.0.x. When you upgrade to TORQUE 5.1.1 from versions prior to 5.0.x, all MOM and server daemons must be upgraded at the same time.

The job format is compatible between 5.1.1 and previous versions of TORQUE. Any queued jobs will upgrade to the new version with the exception of job arrays in TORQUE 2.4 and earlier. It is not recommended to upgrade TORQUE while jobs are in a running state.

Job Arrays

Job arrays from TORQUE version 2.5 and 3.0 are compatible with TORQUE 5.1.1. Job arrays were introduced in TORQUE version 2.4 but modified in 2.5. If upgrading from TORQUE 2.4, you need to make sure all job arrays are complete before upgrading.

serverdb

The pbs_server configuration is saved in the file *$TORQUE_HOME*`/server_priv/serverdb`. When running TORQUE 4.1.0 or later for the first time, this file converts from a binary file to an XML-like format. This format can be used by TORQUE versions 2.5 and 3.0, but not earlier versions. Back up the *$TORQUE_HOME*`/server_priv/serverdb` file before moving to TORQUE 4.1.0 or later.

Jobs

Before upgrading the system, all running jobs must complete. To prevent queued jobs from starting, nodes can be set to offline or all queues can be disabled. Once all running jobs are complete, the upgrade can be made.

Remember to allow any job arrays in version 2.4 to complete before upgrading. Queued array jobs will be lost.

Cray

For upgrading TORQUE to 5.1.1 on a Cray system, refer to **Installation Notes for Moab and TORQUE for Cray** in the *Moab Workload Manager Administrator Guide*

To Upgrade TORQUE

1. Shut down TORQUE.

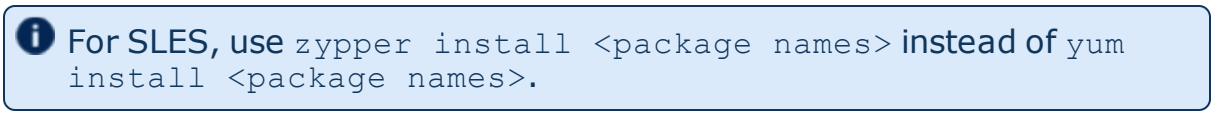
```
[root]# qterm
[root]# momctl -s

* If running TORQUE 4.6.0 or later *
[root]# trqauthd -d

*If running a version of TORQUE earlier than 4.6.0 *
[root]# ps -efw | grep trqauthd
root      1487     1  0 Dec18 ?        00:00:00 /usr/sbin/trqauthd
adaptive  4830  4374  0 15:07 pts/0    00:00:00 grep trqauthd

[root]# kill -9 1487
```

2. Back up your `server_priv` directory.

```
[root]# tar -cvf backup.tar.gz $TORQUE_HOME/server_priv
```

3. If not already installed, install the Boost C++ headers.

```
[root]# yum install boost-devel
```



4. Install the latest TORQUE tarball.

```
[root]# cd /tmp
[root]# tar xzvf torque-<version>-<build number>.tar.gz
[root]# cd torque-<version>-<build number>
[root]# ./configure
[root]# make
[root]# make install
```

5. Follow this step to copy in the new init.d scripts and to merge in any local customizations or merge changes in the stock scripts into your customized ones. Also, follow this step to configure pbs_server and pbs_mom to start automatically at system boot (if you have not done so already).

a. Update the TORQUE pbs_server service.

On the TORQUE Server Head Node, update the pbs_server service startup script.

```
# Make a backup of your current service startup script
[root]# cp /etc/init.d/pbs_server pbs_server.bak

# Copy in the new stock service startup script
* If Debian distribution, do the following *
[root]# cp contrib/init.d/debian.pbs_server /etc/init.d/pbs_server
* If SLES distribution, do the following *
[root]# cp contrib/init.d/suse.pbs_server /etc/init.d/pbs_server
* If RHEL distribution, do the following *
[root]# cp contrib/init.d/pbs_server /etc/init.d

# Merge in any customizations
[root]# vi /etc/init.d/pbs_server

# If you have not done so already, configure the services to start automatically
at system boot.
[root]# chkconfig --add pbs_server
```

b. Update the TORQUE pbs_mom service.

On each TORQUE Mom node, update the pbs_mom service startup script.

```
# Make a backup of your current service startup script
[root]# cp /etc/init.d/pbs_mom pbs_mom.bak

# Copy in the new stock service startup script
* If Debian distribution, do the following *
[root]# cp contrib/init.d/debian.pbs_mom /etc/init.d/pbs_mom
* If SLES distribution, do the following *
[root]# cp contrib/init.d/suse.pbs_mom /etc/init.d/pbs_mom
* If RHEL distribution, do the following *
[root]# cp contrib/init.d/pbs_mom /etc/init.d

# Merge in any customizations
[root]# vi /etc/init.d/pbs_mom

# If you have not done so already, configure the services to start automatically
at system boot.
[root]# chkconfig --add pbs_mom
```

c. Update the TORQUE trqauthd service.

On each node on which TORQUE clients are installed, update the trqauthd service startup script.

```
# Copy in the new stock service startup script
* If Debian distribution, do the following *
[root]# cp contrib/init.d/debian.trqauthd /etc/init.d/trqauthd
* If SLES distribution, do the following *
[root]# cp contrib/init.d/suse.trqauthd /etc/init.d/trqauthd
* If RHEL distribution, do the following *
[root]# cp contrib/init.d/trqauthd /etc/init.d

# If you have not done so already, configure the services to start automatically
at system boot.
[root]# chkconfig --add trqauthd
```

6. Start the services.

```
[root]# service trqauthd start
[root]# service pbs_mom start
[root]# service pbs_server start
```

7. Check the status of jobs in the queue and perform other checks for errors.

```
[root]# qstat
[root]# grep -i error /var/spool/torque/server_logs/*
[root]# grep -i error /var/spool/torque/mom_logs/*
```

Upgrading Moab Workload Manager

The following instructions will guide you through a 6.1.x, 7.0.x, 7.1.x, 7.2.x,7.7.x, 8.0.x to 8.1.1 upgrade. Depending on which version of Moab you are presently running, upgrade instructions may vary, so unless otherwise noted, all instructions assume use of a RHEL operating system; notes for SLES users are added in appropriate places.

You might want to test (see the newest version of Moab on your system (before making the new version live) to verify your policies, scripts, and queues work the way you want them to. See **Testing New Releases** in the *Moab Workload Manager Administrator Guide*.

If you are also upgrading TORQUE from an older version (pre-4.0), you may encounter a problem where Moab HPC Suite core files are regularly created in `/opt/moab`. This can be caused by old TORQUE library files used by Moab that try to authorize with the old TORQUE pbs_iff authorization daemon. You can resolve the problem by removing the old version library files from `/usr/local/lib`.

Because many system-level files and directories are accessed during the installation, the instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

To Upgrade Moab

1. Verify `/etc/yum.repos.d/epel.repo` exists and has the following lines. If not, create it and add these lines.

```
[epel]
name=Extra Packages for Enterprise Linux 6 - x86_64
mirrorlist=http://mirrors.fedoraproject.org/mirrorlist?repo=epel-6&arch=x86_64
failovermethod=priority
enabled=1
gpgcheck=1
gpgkey=http://download.fedoraproject.org/pub/epel/RPM-GPG-KEY-EPEL-6
```

   SLES users must add a repository to YaST. The URL of the repository is http://download.opensuse.org/repositories/server:/database/SLE_11_SP3/.

2. Untar the distribution file. For example:

```
[root]# tar -xzvf moab-<version>-<OS>.tar.gz
```

3. Change directory into the extracted directory.
4. Configure the installation package.

   Use the same configure options as when Moab was installed previously. If you cannot remember which options were used previously, check the `config.log` file in the directory where the previous version of Moab was installed from.

   For a complete list of configure options, use `./configure --help`.

5. Stop Moab.

```
[root]# mschedctl -k
moab will be shutdown immediately
```

   While Moab is down, all currently running jobs continue to run on the nodes, the job queue remains intact, and new jobs cannot be submitted to Moab.

6. Before proceeding to the following steps, consider backing up your Moab Workload Manager home directory (`/opt/moab/` by default).
7. If you are using green computing, or if you are using a resource manager other than TORQUE, run the make perldeps command to install the necessary perl modules using CPAN (and install CPAN if you have not already done so). When first running CPAN, you will be asked for configuration information. It is recommended that you choose an automatic configuration. You will be prompted to provide input during module installation; running the make perldeps command with a script is not recommended.

```
[root]# yum install perl-CPAN
[root]# make perldeps
```

8. Install Moab.

```
[root]# make install
```

> Default configuration files are installed during make install. Existing configuration files are not overwritten and the new files are given a .dist extension.

9. If you use ODBC, you must upgrade to the 8.1.1 schema. See **Migrating Your Database to Newer Versions of Moab** in the *Moab Workload Manager Administrator Guide* for more information.
10. Verify the version number is correct before starting the new server version.

```
[root]# moab --about

Defaults:   server=:42559  cfgdir=/opt/moab  vardir=/opt/moab
Build dir:  /tmp/develop
Build host: crom
Build date: Mon Jun 16 16:00:00 MST 2014
Build args: NA
Compiler Flags:  -D__M64 -D_BUILDDATETIME="2014061616" -DMUSEWEBSERVICES -
DMUSEZEROMQ -DMUSEMONGODB -DMMAX_GRES=512 -DMMAX_RANGE=2048 -DMMAX_TASK=32768 -fPIC
-gdwarf-3 -Wall -Wextra -DVALGRIND -x c++ -std=c++11 -DDMAX_PJOB=512 -D_GNU_SOURCE
Compiled as little endian.
Version: moab server master (revision 2014061616, changeset
90ce9f804ddd09b061238e438ecb4d117cc83e81)
Copyright (C) 2000-2014 by Adaptive Computing Enterprises, Inc. All Rights
Reserved.
```

11. If you are upgrading from Moab Workload Manager 7.1 or earlier and use Moab Accounting Manager:
    - If you use the native interface (AMCFG[...] **TYPE**=*native*), locate the following entries in the `moab.cfg` file:

      ```
      AMCFG[mam] RESERVEFAILUREACTION=hold,hold
      AMCFG[mam] CREATEFAILUREACTION=ignore
      ```

      Replace the **RESERVEFAILUREACTION** attribute with STARTFAILUREACTION. You can also update CREATEFAILUREACTION if you want to change how Moab handles different types of create job failures.

      ```
      AMCFG[mam] STARTFAILUREACTION=hold,hold
      AMCFG[mam] CREATEFAILUREACTION=ignore,ignore
      ```

    - If you use the gold interface (**AMCFG**[...] **TYPE**=*GOLD* or **AMCFG**[...] **SERVER**=*gold://...*), the interface name has changed to MAM. Modify the **AMCFG TYPE** or **SERVER** attribute to reference MAM (**AMCFG**[...] **TYPE**=*MAM*

or **AMCFG** [...] **SERVER**=*mam://...*). You must also replace the **JOBFAILUREACTION** attribute with STARTFAILUREACTION.

```
AMCFG[mam] SERVER=mam://my_accounting_server
AMCFG[mam] STARTFAILUREACTION=hold,hold
```

12. If you are using Moab Accounting Manager with the native interface (**TYPE**=*native*), remove all entries in `moab.cfg` with the form (AMCFG[*] *URL=exec://*), except for those that you have customized.

> In Moab Workload Manager 8.1.0, Moab defaults to using a set of stock scripts that no longer need to be explicitly configured in the server configuration file.

13. Start Moab.

```
[root]# moabd
```

14. If you will be using Moab Web Services, you must configure a secret key. See Secure communication using secret keys. on page 45

Upgrading Moab Accounting Manager

The following procedure updates Moab Accounting Manager to a new release version. It includes instructions for migrating your database schema to a new version if necessary.

Moab Accounting Manager uses the standard `configure`, `make` and `make install` steps for upgrades. This document provides a number of sample steps referenced to a particular installation on a Linux platform using the bash shell. These steps indicate the user ID in brackets performing the step. The exact commands to be performed and the user that issues them will vary based on the platform, shell, installation preferences, and other factors.

To Upgrade Moab Accounting Manager

1. Determine the MAM Accounting admin user and change to that user.

```
[root]# glsuser | grep 'Accounting Admin'
mam      True                                                Accounting Admin
[root]# su - mam
```

2. Determine whether you need to migrate your database. To do so, check the current database schema version by running `goldsh System Query`. If the current version is lower than 8.1, you must migrate your database. The steps required to do so are incorporated in these steps.

```
[mam]$ goldsh System Query
```

3. Stop the server daemon.

```
[mam]$ goldd -k
```

4. If you determined that you must migrate your database, create a database backup.
   - PostgreSQL database

```
[mam]$ pg_dump -U moab -W <old_database_name> > /tmp/<old_database_name>.sql
```

   - MySQL database

```
[mam]$ mysqldump -u moab -p <old_database_name> > /tmp/<old_database_name>.sql
```

5. Verify that each of the prerequisites listed in Installing Moab Accounting Manager on page 25 has been satisfied.
6. Unpack the tar archive and change directory into the top directory of the distribution.

```
[mam]$ cd ~/src
[mam]$ tar -zxvf mam-8.1.1.tar.gz
[mam]$ cd mam-8.1.1
```

7. Configure Moab Accounting Manager by running the `configure` script with the desired options.

   It is recommended that you use the same configure options that were used in the previous installation. You can examine the config.log file where you unpacked your previous distribution to help determine the configuration options that were used to install the prior version of MAM.

   In addition to your previous configuration options, it is recommended that you specify the prior symmetric key used between Moab Workload Manager and Moab Accounting Manager via the `--with-key` configure option so that you do not have to change the key in Moab. You can find this key in the prior auth_key or `site.conf` file.

   The examples in this guide demonstrate installing the new version of Moab Accounting Manager over the previous version by using the default directory, database name and port; however, if you are migrating the database, you can install the new version of Moab Accounting Manager with a new installation directory, port and database name by specifying `--prefix`, `--with-port` and `--with-db-name` configuration options that are different from the old version. This would allow you to run both the new and old versions simultaneously.

```
[mam]$ ./configure --with-key=<MAMSecretKey>
```

8. To compile the program, type `make`.

```
[mam]$ make
```

> If you only need to install the clients on a particular system, replace make with make clients-only. If you only need to install the web GUI on a particular system, replace make with make gui-only.

9. Run `make install` as root to install Moab Accounting Manager.

```
[mam]$ su -c "make install"
```

> If you only need to install the clients on a particular system, replace "make install" with "make install-clients-only". If you only need to install the web GUI on a particular system, replace "make install" with "make install-gui-only".

10. If you are migrating your database and used the `--with-db-name` option to specify a new database name that does not already exist:
    a. Create and populate the database from the dump.
       - PostgreSQL database
       ```
       [postgres]$ psql
       create database "<new_db_name>";
       ```
       - MySQL database
       ```
       [root]# mysql
       create database `<new_db_name>`;
       ```
    b. Import the old data into the new database.
       - PostgreSQL database
       ```
       [mam]$ psql -U moab -W <new_db_name> < /tmp/<old_db_name>.sql
       ```
       - MySQL database
       ```
       [mam]$ mysql -u moab -p <new_db_name> < /tmp/<old_db_name>.sql
       ```
11. Edit the configuration files as necessary. You may want to compare your existing configuration files with those distributed with the new release to determine if you want to merge and change any of the new options within your configuration files.

```
[mam]$ diff /opt/mam/etc/goldd.conf /opt/mam/etc/goldd.conf.dist
```

    Ensure that your current path points to your newly installed clients and server.

```
[mam]$ which goldd
/opt/mam/sbin/goldd
```

12. Start the server daemon back up.

```
[mam]$ goldd
```

13. If you are migrating your database to 8.1, you will do so by running one or more migration scripts. You must run every incremental migration script between the version you are currently using and the new version (8.1). These scripts are designed to be rerunnable, so if you encounter a failure, resolve the failure and rerun the migration script. If you are unable to resolve the failure and complete the migration, contact Support.

    For example, if you are migrating from Moab Accounting Manager version 7.2, you must run four migration scripts: the first to migrate the database schema from 7.2 to 7.3, the second to migrate from 7.3 to 7.5, the third to migrate the database schema from 7.5 to 8.0 and the fourth to migrate the database schema from 8.0 to 8.1.

```
[mam]$ sbin/migrate_7.2-7.3.pl
[mam]$ sbin/migrate_7.3-7.5.pl
[mam]$ sbin/migrate_7.5-8.0.pl
[mam]$ sbin/migrate_8.0-8.1.pl
```

14. Verify that the resulting database schema version is 8.1.

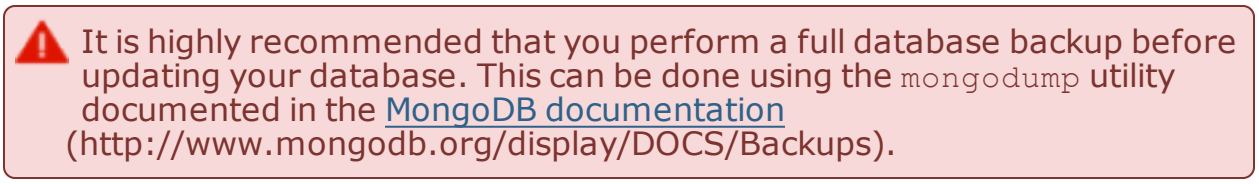
```
[mam]$ goldsh System Query

Name                    Version Description
----------------------- ------- ------------------
Moab Accounting Manager 8.1     Commercial Release
```

15. Verify that the executables have been upgraded to 8.1.

```
[mam]$ goldd -v

Moab Accounting Manager version 8.1
```

Upgrading MWS

Before upgrading MWS, we recommend you upgrade to Java 7 and MongoDB 2.4.x. To upgrade Java, repeat the instructions to Install Java on page 40. To upgrade MongoDB, see Upgrading MongoDB on page 64.



To Upgrade MWS

1. Extract the contents of the MWS download tarball into a temporary directory. For example:

```
[root]# mkdir /tmp/mws-install
[root]# cd /tmp/mws-install
[root]# mv mws-8.1.1.tar.gz .
[root]# tar xvzf mws-8.1.1.tar.gz
[root]# cd /tmp/mws-install/mws-8.1.1
```

2. Stop Tomcat, re-deploy `mws.war`, and remove the exploded `mws` directory.

```
# CentOS 6 example

[root]# service tomcat6 stop
[root]# cp /tmp/mws-install/mws-8.1.1/mws.war /usr/share/tomcat6/webapps
[root]# rm -rf /usr/share/tomcat6/webapps/mws
```

3. Create the MWS home directory and subdirectories. See **Configuration** in the Moab Web Services *Reference Guide*.

> The default location for the MWS home directory is `/opt/mws`. These instructions assume the default location.

Here is a sample script for this setup:

```
[root]# mkdir -p \
    /opt/mws/etc/mws.d \
    /opt/mws/hooks \
    /opt/mws/log \
    /opt/mws/plugins \
    /opt/mws/spool/hooks \
    /opt/mws/utils
[root]# chown -R tomcat:tomcat /opt/mws # Depending on your OS, the Tomcat username
might be tomcat6.
[root]# chmod -R 555 /opt/mws
[root]# chmod u+w \
    /opt/mws/log \
    /opt/mws/plugins \
    /opt/mws/spool \
    /opt/mws/spool/hooks \
    /opt/mws/utils
```

4. Copy the extracted utility files to the utility directory created above and give the tomcat user ownership of the directory.

```
[root]# cd /tmp/mws-install/mws-8.1.1/utils
[root]# cp * /opt/mws/utils
[root]# chown tomcat:tomcat /opt/mws/utils/*
```

5. Set up the MWS configuration files. In the extracted directory are several configuration files.

   a. Merge the changes in the new `mws-config.groovy` file into your existing `/opt/mws/etc/mws-config.groovy`.

```
~~moab.messageQueue.port = 5563~~
moab.messageQueue.port = 5570


log4j = {
  // Configure an appender for the events log.
  def eventAppender = new org.apache.log4j.rolling.RollingFileAppender(
    name: 'events', layout: pattern(conversionPattern: "%m%n"))
  def rollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
    fileNamePattern: '/opt/mws/log/events.%d{yyyy-MM-dd}',
    activeFileName: '/opt/mws/log/events.log')
  rollingPolicy.activateOptions()
  eventAppender.setRollingPolicy(rollingPolicy)

  // Configure an appender for the audit log.
  def auditAppender = new org.apache.log4j.rolling.RollingFileAppender(
      name: 'audit',
      layout: new com.ace.mws.logging.ACPatternLayout("%j\t\t\t%c{1}
\t\t\t%m%n"))
  def auditRollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
      fileNamePattern: '/opt/mws/log/audit.%d{yyyy-MM-dd}',
      activeFileName: '/opt/mws/log/audit.log')
  auditRollingPolicy.activateOptions()
  auditAppender.setRollingPolicy(auditRollingPolicy)

  appenders {
    rollingFile name: 'stacktrace',
        file: '/opt/mws/log/stacktrace.log',
        maxFileSize: '100MB'
    rollingFile name: 'rootLog',
        file: '/opt/mws/log/mws.log',
        maxFileSize: '100MB', //The maximum file size for a single log file
        maxBackupIndex: 10, //Retain only the 10 most recent log files, delete
older logs to save space
        ~~layout:pattern(conversionPattern: '%d %p %c %m%n'), //Configures the
output format of each log entry~~
        layout: new com.ace.mws.logging.ACPatternLayout(), //Configures the
output format of each log entry
        threshold: org.apache.log4j.Level.ERROR //Ignore any logging entries
less verbose than this threshold

    appender eventAppender
    appender auditAppender
  }

  // NOTE: This definition is a catch-all for any logger not defined below
  root {
    error 'rootLog'
  }

  // Individual logger configurations
  ...

  // Logs event information to the events log, not the rootLog
  trace additivity:false, events:'com.ace.mws.events.EventFlatFileWriter'
  // Logs audit information to the audit log, not the rootLog
  trace additivity:false, audit:'mws.audit'
}
```

Additions are noted in red. Removed content is stricken out.

Pay special attention to these changes:

- default moab message queue port
- addition of the "auditAppender" in the default logging configuration of `/tmp/mws-install/mws-8.1.1/mws-config.groovy`
- **mws.suite** parameter and the **mam.*** parameters have been moved to a suite-specific file in `/opt/mws/etc/mws.d/` and do not need to exist in `/opt/mws/etc/mws-config.groovy`
- value for **moab.messageQueue.secretKey** should match the value located in `/opt/moab/etc/moab-private.cfg`; if you have not yet configured a secret key, see Secure communication using secret keys. on page 45

b. Merge any changes supplied in the new `mws-config-hpc.groovy` file in to your installed `/opt/mws/etc/mws.d/mws-config-hpc.groovy`.

c. Verify the Tomcat user has read access to `/opt/mws/etc/mws-config.groovy` and `/opt/mws/etc/mws.d/mws-config-hpc.groovy` file.

6. Upgrade the schema of the `mws` database in MongoDB.

   You *must* perform this step, regardless of whether you upgraded MongoDB to version 2.4.x or not.

   Run the database migration script provided with MWS. (It is safe to run this script more than once. If for any reason, errors occur during the execution of the script, run it again.)

   ```
   [root]# mongo -u mws_user mws /opt/mws/utils/db-migrate.js -p
   ```

   The script might take several minutes to execute.

7. Start Tomcat.

   ```
   [root]# service tomcat6 start
   ```

8. Visit `http://<localhost>:8080/mws/` in a web browser to verify that MWS is running again.

   You will see some sample queries and a few other actions.

9. Log into MWS to verify configuration. (The credentials are the values of **auth.defaultUser.username** and **auth.defaultUser.password** set in `/opt/mws/etc/mws-config.groovy`.)

If you encounter problems, or if MWS does not seem to be running, see the steps in Troubleshooting on page 135.

Migrating the MAM Database from MySQL to PostgreSQL

PostgreSQL is now the preferred DBMS for MAM. Customers who have already installed MySQL as the DBMS for MAM are not required to migrate their database to use PostgreSQL at this time. However, MySQL is considered deprecated and new installations will only use PostgreSQL.

PostgreSQL does not provide a standard procedure for migrating an existing database from MySQL to PostgreSQL. Adaptive Computing has had success using the py-mysql2pgsql tools for migrating/converting/exporting data from MySQL to PostgreSQL. See https://github.com/philipsoutham/py-mysql2pgsq for additional details.

To Migrate the MAM Database

This procedure was successfully tested on an actual customer MySQL database with millions of transactions on CentOS 6.4. It completed in less than an hour.

1. Make a backup copy of your MySQL mam database.

```
[root]# mysqldump mam > /archive/mam.mysql
```

2. Follow the instructions to Install PostgreSQL in the *Moab HPC Suite Installation and Configuration Guide*.
   - Manual Install - Preparing for Manual Installation on page 12
   - RPM Install - Installing Moab HPC Suite RPM on page 82
3. Install the prerequisite packages.

```
[root]# yum install git postgresql-devel gcc MySQL-python python-psycopg2 PyYAML
termcolor python-devel
```

4. Install pg-mysql2pgsql (from source).

```
[root]# cd /software
[root]# git clone git://github.com/philipsoutham/py-mysql2pgsql.git
[root]# cd py-mysql2pgsql
[root]# python setup.py install
```

5. Run pg-mysql2pgsql once to create a template yaml config file.

```
[root]# py-mysql2pgsql -v
```

6. Edit the config file to specify the MySQL database connection information and a file to output the result.

```
[root]# vi mysql2pgsql.yml
```

```
mysql:
hostname: localhost
port: 3306
socket:
username: mam
password: changeme
database: mam
compress: false
destination:
# if file is given, output goes to file, else postgres
file: /archive/mam.pgsql
postgres:
hostname: localhost
port: 5432
username:
password:
database:
```

7. Run the pg-mysql2pgsql program again to convert the database.

```
[root]# py-mysql2pgsql -v
```

8. Create the mam database in PostgreSQL.

```
[root]# su - postgres
[postgres]$ psql
postgres=# create database "mam";
postgres=# create user mam with password 'changeme!';
postgres=# \q
[postgres]$ exit
```

9. Import the converted data into the PostgreSQL database.

```
[root]# su - mam
[mam]$ psql mam < /archive/mam.pgsql
```

10. Point MAM to use the new postgresql database.

```
[mam]$ cd /software/mam-latest
[mam]$ ./configure                  # This will generate an etc/goldd.conf.dist
file
[mam]$ vi /opt/mam/etc/goldd.conf   # Merge in the database.datasource from
etc/goldd.conf.dist
```

11. Restart Moab Accounting Manager.

```
[mam]$ goldd -r
```

Chapter 3 RPM installation Guide

This chapter provides installation, configuration, and upgrading information using the RPM install process.

Related Topics

- Requirements on page 3
-

Installation

In this section:

Installing Moab HPC Suite RPM

This topic contains instructions on how to install TORQUE Resource Manager, Moab Workload Manager, Moab Accounting Manager, and Moab Web Services installed on one server using the 8.1.1 suite RPM.

The RPM installation only supports installation on CentOS 6.x, 7.x, RHEL 6.x, 7.x, or Scientific Linux 6.x, 7.x. See Preparing for Manual Installation on page 12 if installing on other supported operating systems.

Because many system-level files and directories are accessed during the installation, the instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

If you want to build a custom RPM for component documentation (Moab Workload Manager, Moab Accounting Manager, or Moab Web Services), see the instructions in the Installing topic for the respective component (Manual Installation section).

In this topic:

Install Java

Install the Linux x64 RPM version of Oracle® Java® 7 Runtime Environment.

> The Oracle® Java® download page has moved and requires a web-enabled workstation to accept the license agreement and download the software.

> Oracle Java 7 Runtime Environment is the recommended Java environment, but Oracle Java 6 is also supported. All other versions of Java, including OpenJDK/IcedTea, GNU Compiler for Java, and so on cannot run Moab Web Services.

Do the following:

1. Download Java 7 on the web-enabled workstation.
   a. Open the web browser and connect to the Java downloads page (http://www.oracle.com/technetwork/java/javase/downloads/jre7-downloads-1880261.html).
   b. Select the radio button to accept the license agreement.
   c. Click the download link for the Linux x64 rpm file.
2. Copy the Java 7 download to the server using scp, rsync, or any similar network copy utility.
3. On the server, run the following to install Java 7:

```
[root]# rpm -Uh jre-7-linux-x64.rpm
```

Installing the Suite RPM

1. If you are upgrading from a previous installation of Moab, back up your `/opt/moab/tools` directory to prevent losing modifications made to the perl scripts. If you are performing a clean installation of Moab HPC Suite, skip this step.

```
[root]# tar czf backup-tools.tar.gz /opt/moab/tools
```

2. Download the latest 8.1.1 RPM suite tarball (`moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz`, for example) from the Adaptive Computing website.
3. Untar the downloaded package.

```
[root]# tar zxf moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz
```

4. Change directories into the untarred directory.

   Consider reviewing the README file for additional details on using the RPM distribution tarball.

5. Install the suite repositories. The `-y` option installs with the default settings for the RPM suite.

   For a description of the options of the repository installer script, run:

   ```
   [root]# ./install-rpm-repos.sh -h
   ```

   ```
   [root]# ./install-rpm-repos.sh [<repository-directory>] [-y]
   ```

   If the installation returns the following warning line:

   `Warning: RPMDB altered outside of yum.`

   This is normal and can safely be ignored.

   The [<*repository-directory*>] option is the directory where you want to copy the RPMs. If no argument is given, run "`install-rpm-repos.sh -h`" and note the default directory location. If the [<*repository-directory*>] already exists, RPMs will be added to the existing directory. No files are overwritten in [<*repository-directory*>]. A repository file is also created in `/etc/yum.repos.d/` and points to the [<*repository-directory*>] location.

   For ease in repository maintenance, the install script fails if Adaptive Computing RPMs are copied to different directories. If a non-default [<*repository-directory*>] is specified, please use the same directory for future updates.

   The script installs the `createrepo` package and its dependencies. You must answer "y" to all the questions in order for the RPM install of the suite to work. Additionally, the script installs the EPEL and 10gen repositories.

6. Test the repository.

   ```
   [root]# yum search moab
   ```

   If no error is given, the repository is correctly installed. The output will look similar to the following (varying slightly depending on the suite and build type):

```
...
moab-hpc-accounting-manager.x86_64 : Moab Accounting Manager for Moab HPC Suite
moab-hpc-enterprise-suite.noarch : Moab HPC Enterprise Suite virtual package
moab-perl-RRDs.noarch : Moab RRDs
moab-tomcat-config.x86_64 : Tomcat Configuration for Web Services
moab-verify-oracle-java.noarch : Java Validator for Web Services
moab-web-services.x86_64 : Moab Web Services
moab-workload-manager.x86_64 : Moab Workload Manager
moab-workload-manager-client.x86_64 : Moab Workload Manager Client
moab-workload-manager-common.x86_64 : Moab Workload Manager Common Files
moab-perl-data.noarch : Perl Configuration for perl packages by Adaptive Computing
moab-torque-client.x86_64 : TORQUE Client
moab-torque-common.x86_64 : TORQUE Common Files
moab-torque-devel.x86_64 : TORQUE Development Files
moab-torque-mom.x86_64 : TORQUE MOM agent
moab-torque-server.x86_64 : TORQUE Server
moab-web-services-hpc-configuration.x86_64 : MWS configuration for HPC
moab-workload-manager-hpc-configuration.x86_64 : MWM configuration for HPC
```

7. Install the suite package.

```
[root]# yum install moab-hpc-enterprise-suite
```

If you encounter the following error:

```
...
  --> Finished Dependency Resolution
krb5-workstation-1.6.1-62.el5.x86_64 from installed has depsolving problems
  --> Missing Dependency: krb5-libs = 1.6.1-62.el5 is needed by package
krb5-workstation-1.6.1-62.el5.x86_64 (installed)
krb5-workstation-1.6.1-62.el5.x86_64 from installed has depsolving problems
  --> Missing Dependency: krb5-libs = 1.6.1-62.el5 is needed by package
krb5-workstation-1.6.1-62.el5.x86_64 (installed)
Error: Missing Dependency: krb5-libs = 1.6.1-62.el5 is needed by package
krb5-workstation-1.6.1-62.el5.x86_64 (installed)
You could try using --skip-broken to work around the problem
You could try running: package-cleanup --problems
package-cleanup --dupes
rpm -Va --nofiles --nodigest
```

Install the `krb5-workstation` package, then execute the install suite package again.

```
[root]# yum install krb5-workstation
[root]# yum install moab-hpc-enterprise-suite
```

If you encounter CURL library errors, make sure you are installing the correct version for your OS.

8. Install and prepare the MongoDB database by doing the following:
   a. Install `mongo-10gen-server`.

```
[root]# yum install mongo-10gen-server
```

b. Start MongoDB.

> There may be a short delay (approximately three minutes) for MongoDB to start the first time.

- Red Hat 6-based systems

```
[root]# chkconfig mongod on
[root]# service mongod start
```

- Red Hat 7-based systems

```
[root]# cat > /usr/lib/systemd/system/mongodb.service <<End-of-file
[Unit]
Description=High-performance, schema-free document-oriented database
After=syslog.target network.target

[Service]
Type=forking
User=mongod
Group=mongod
Environment=CONFIG=/etc/mongod.conf
Environment=OPTIONS=
EnvironmentFile=-/etc/sysconfig/mongod
ExecStart=/usr/bin/mongod -f \$CONFIG \$OPTIONS
PrivateTmp=true
LimitNOFILE=65536
TimeoutStartSec=180
StandardOutput=syslog
StandardError=syslog

[Install]
WantedBy=multi-user.target
End-of-file
[root]# rm -f /etc/init.d/mongod
[root]# systemctl enable mongodb.service
[root]# systemctl start mongodb.service
```

c. Add the required MongoDB users.

> The passwords used below (`secret1`, `secret2`, and `secret3`) are examples. Choose your own passwords for these users.

```
[root]# mongo
> use admin;
> db.addUser("admin_user", "secret1");
> db.auth("admin_user", "secret1");

> use moab;
> db.addUser("moab_user", "secret2");
> db.addUser("mws_user", "secret3", true);

> use mws;
> db.addUser("mws_user", "secret3");
> exit
```

> Because the `admin_user` has read and write permissions to the `admin` database, it also has read and write permissions to all other databases. See Control Access to MongoDB Instances with Authentication (http://docs.mongodb.org/manual/tutorial/control-access-to-mongodb-with-authentication/) for more information.

d. Enable authentication in MongoDB.

- Red Hat 6-based systems

```
[root]# vi /etc/mongod.conf

auth = true

[root]# service mongod restart
```

- Red Hat 7-based systems

```
[root]# vi /etc/mongod.conf

auth = true

[root]# systemctl restart mongodb.service
```

Installing PostgreSQL

If you plan to use Moab Workload Manager with ODBC or Moab Accounting Manager, you must install a PostgreSQL database.

To install PostgreSQL

1. Install and initialize PostgreSQL.

- Red Hat 6-based systems

```
[root]# yum install postgresql-server
[root]# service postgresql initdb
```

- Red Hat 7-based systems

```
[root]# yum install postgresql-server
[root]# postgresql-setup initdb
```

2. Configure trusted connections.

   Modify the "host" lines in the pg_hba.conf file for the interfaces from which the server(s) (for example, Moab Workload Manager and/or Moab Accounting Manager) will be connecting to the database and ensure that it specifies a secure password-based authentication method (for example, md5).

```
[root]# vi /var/lib/pgsql/data/pg_hba.conf

# IPv4 local connections:
host    all             all             127.0.0.1/32            md5
# IPv6 local connections:
host    all             all             ::1/128                 md5
```

If the "host" lines are not present, add them as they appear above.

3. Configure PostgreSQL to accept connections from your host.

```
[root]# vi /var/lib/pgsql/data/postgresql.conf

# Uncomment the listen addresses line in the configuration:

listen_addresses = 'localhost'          # what IP address(es) to listen on;
```

4. Start or restart the database.
   - Red Hat 6-based systems

     ```
     [root]# chkconfig postgresql on
     [root]# service postgresql restart
     ```

   - Red Hat 7-based systems

     ```
     [root]# systemctl enable postgresql.service
     [root]# systemctl restart postgresql.service
     ```

Configuring TORQUE

This topic contains instructions on how to configure and start TORQUE.

If you intend to use TORQUE 5.1.1 with Moab, you must run Moab version 8.1.1 or 8.0.x. TORQUE 5.1.1 will not work with versions earlier than Moab 8.0.

In this topic:

Prerequisites

Open Necessary Ports

TORQUE requires certain ports to be open for essential communication:

- For client communication to `pbs_server`, all privileged ports must be

open (ports under 1024).

- For `pbs_server` communication to `pbs_mom`, the default port is 15003.
- For `pbs_mom` to `pbs_server`, the default port is 15001.

For more information on how to configure the ports that TORQUE uses for communication, see **Configuring Ports** in the *TORQUE Resource Manager Adminstrator Guide*.

If you have a firewall enabled, do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the TORQUE server for client and MOM communication
-A INPUT -p tcp --dport 15001 -j ACCEPT

# Needed on the TORQUE MOM for server and MOM communication
-A INPUT -p tcp --dport 15002 -j ACCEPT
-A INPUT -p tcp --dport 15003 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=15001/tcp --permanent
[root]# firewall-cmd --add-port=15002/tcp --permanent
[root]# firewall-cmd --add-port=15003/tcp --permanent
[root]# firewall-cmd --reload
```

Verify the hostname

Make sure your host (with the correct IP address) is in your `/etc/hosts` file. To verify that the hostname resolves correctly, make sure that hostname and hostname -f report the correct name for the host.

Configure TORQUE

Do the following:

1. Add nodes to the `/var/spool/torque/server_priv/nodes` file. For information on syntax and options for specifying compute nodes, see **Managing Nodes** in the *TORQUE Resource Manager Adminstrator Guide*.
2. Start the servers.
   - Red Hat 6-based systems

```
[root]# service trqauthd start
[root]# service pbs_server start
[root]# service pbs_mom start
```

- Red Hat 7-based systems

```
[root]# systemctl start trqauthd.service
[root]# systemctl start pbs_server.service
[root]# systemctl start pbs_mom.service
```

Install TORQUE MOMs

Do the following:

1. In most installations, you will install a TORQUE MOM on each of your compute nodes. To install the TORQUE MOMs in the directory of the unpackaged tarball, copy the `moab-torque-common` and `moab-torque-mom` RPM files to each MOM node.

```
[root]# scp RPMs/moab-torque-common-*.rpm <mom-node>
[root]# scp RPMs/moab-torque-mom-*.rpm <mom-node>
```

2. On each MOM node, install the RPMs, making sure that `moab-torque-common` is installed first.

```
[root]# ssh root@<mom-node>
[root]# yum install moab-torque-common-*.rpm moab-torque-mom-*.rpm
```

3. On each MOM node, create or edit the `/var/spool/torque/server_name` file to contain the hostname of the TORQUE server.

```
[root]# echo <torque_server_hostname> > /var/spool/torque/server_name
```

4. Edit the `/var/spool/torque/mom_priv/config` file on each TORQUE MOM node. This file is identical for all compute nodes and can be created on the head node and distributed in parallel to all systems.

```
[root]# vi /var/spool/torque/mom_priv/config

$pbsserver     <torque_server_hostname>   # hostname running pbs server
$logevent      225                        # bitmap of which events to log
```

5. On each TORQUE server MOM node, start the pbs_mom daemon.

- Red Hat 6-based systems

```
[root]# service pbs_mom start
```

- Red Hat 7-based systems

```
[root]# systemctl start pbs_mom.service
```

Related Topics

Installing Moab HPC Suite RPM on page 82
Configuring Moab Workload Manager on page 91

Configuring Moab Workload Manager

This topic contains instructions on how to configure and start Moab Workload Manager (Moab).

In this topic:

Open Necessary Ports

Moab Workload Manager uses a configurable server port (default 42559) for client-server communication. If you intend to run client commands on a host other than the Moab Head Node, or if you will be using Moab in a grid, and if you have a firewall enabled, then you will need to configure the firewall to allow the server port.

Do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the Moab server for off-host client communication
-A INPUT -p tcp --dport 42559 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=42559/tcp --permanent
[root]# firewall-cmd --reload
```

Configure Moab Workload Manager

Do the following:

1. Source the following file to add the Moab executable directories to your current shell *$PATH* environment.

   ```
   [root]# . /etc/profile.d/moab.sh
   ```

2. Copy your license file into the same directory as `moab.cfg` (`/opt/moab/etc/` by default). For example:

   ```
   [root]# cp moab.lic $MOABHOMEDIR/etc/moab.lic
   ```

   To verify the current status of your license, use `moab --about`.

Moab checks the status of the license every day just after midnight. At 60 and 45 days before, and daily from 30 days before license expiration to and including the license expiration date, Moab sends an e-mail to all level 1 administrators informing them of the pending Moab license expiration. A log record is also made of the upcoming expiration event. For the notifications to occur correctly, you must enable administrator email notification (see **Notifying Administrators of Failures** in the *Moab Workload Manager Administrator Guide*) and `moab.cfg` must contain email addresses for level 1 administrators. For example:

```
ADMINCFG[1] USERS=u1,u2,u3[,...]

USERCFG[u1] EMAILADDRESS=u1@company.com
USERCFG[u2] EMAILADDRESS=u2@company.com
USERCFG[u3] EMAILADDRESS=u3@company.com

MAILPROGRAM DEFAULT
```

Moab will not run without a license. For information about obtaining a trial license, please contact Adaptive Computing.

3. If you are also installing Moab Accounting Manager, uncomment the **AMCFG** lines in the `/opt/moab/etc/moab.cfg` file.

```
AMCFG[mam] TYPE=MAM HOST=localhost
```

4. Start Moab (assumes Moab configured with the `--with-int` option).
   - Red Hat 6-based systems

```
[root]# chkconfig moab on
[root]# service moab start
```

   - Red Hat 7-based systems

```
[root]# systemctl enable moab.service
[root]# systemctl start moab.service
```

5. If you have a resource manager configured, submit a sleep job as a non-root user (adaptive is used in this example) and verify the job is running.

```
[root]# su - adaptive
[adaptive]$ echo sleep 150 | msub
[adaptive]$ showq
[adaptive]$ exit
```

6. Connecting Moab to MongoDB

   If you will be installing Moab Web Services, connect Moab to MongoDB using the following instructions:

The USEDATABASE parameter is unrelated to the MongoDB configuration.

a. In `/opt/moab/etc/moab.cfg`, set the **MONGOSERVER** parameter to the correct location of the MongoDB server. By default, Moab assumes it is on the same server.

```
MONGOSERVER <host>[:<port>]
```

b. In the `/opt/moab/etc/moab-private.cfg` file, set the **MONGOUSER** and **MONGOPASSWORD** parameters to the MongoDB `moab_user` credentials you set.

```
MONGOUSER     moab_user
MONGOPASSWORD secret2
```

c. Verify that Moab is able to connect to MongoDB.

- Red Hat 6-based systems

```
[root]# service moab restart
[root]# mdiag -S
...
Mongo connection (localhost) is up (credentials are set)
...
```

- Red Hat 7-based systems

```
[root]# systemctl restart moab.service
[root]# mdiag -S
...
Mongo connection (localhost) is up (credentials are set)
...
```

Related Topics

Installing Moab HPC Suite RPM on page 82
Configuring TORQUE on page 88

Configuring Moab Accounting Manager

This topic contains instructions on how to configure and start Moab Accounting Manager (MAM).

Perform the following in order:

- Configure Moab Workload Manager to use Moab Accounting Manager on page 100
- Initialize Moab Accounting Manager on page 101

Plan Your Installation

The first step is determining the number of separate hosts (physical machines) required for your MAM installation.

Your MAM installation includes:

- MAM Server
- MAM Database
- MAM GUI (optional)
- MAM Clients (possibly several hosts)

Each of these components can be installed on their own hosts (meaning the actual physical machine) or can be combined on same hosts. For example, the MAM Database can be installed on the same *host* as the MAM Server. Or the MAM Server may be installed on the same host you installed the Moab Server.

Once you have determined which components are installed on which hosts, complete the rest of the instructions for the MAM installation.

> The instructions that follow in this topic will use the term Host after each component to reflect installing on a host (again, meaning the physical machine). For example, MAM Server Host and MAM Database Host. Depending on your configuration, Host may refer to as installed on its own machine or installed on the same machine as another component.

Confirm Requirements

Hardware Requirements

- Dual or Quad core Intel/AMD x86-64 processor
- At least 8 GB of RAM
- 1-2 TB disk space

> MAM is commonly installed on the same host as Moab; however, in some cases you might obtain better performance by installing them on separate hosts.

Supported Operating Systems

MAM has been tested on the following variants of Linux:

- CentOS (6.x, 7.x)
- RHEL (6.x, 7.x)
- Scientific Linux (6.x, 7.x)

Supported Databases

MAM uses an RDBMS as a back end. If this is a new installation, use the following database:

- PostgreSQL 7.2 or higher

Open Necessary Ports

If your site is running firewall software on its hosts, you will need to configure the firewall to allow connections to the necessary ports.

Do the following as needed:

1. If you will be installing the MAM Server on a separate host than you installed the Moab Server *or* you will be installing the MAM Clients on other hosts, then on the MAM Server Host, open the MAM Server port (7112) in the firewall.
   - Red Hat 6-based systems using iptables

     ```
     [root]# iptables-save > /tmp/iptables.mod

     [root]# vi /tmp/iptables.mod

     # Add the following lines immediately *before* the line matching
     # "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
     -A INPUT -p tcp --dport 7112 -j ACCEPT

     [root]# iptables-restore < /tmp/iptables.mod

     [root]# service iptables save
     ```

   - Red Hat 7-based systems using firewalld

     ```
     [root]# firewall-cmd --add-port=7112/tcp --permanent

     [root]# firewall-cmd --reload
     ```

2. If using the MAM GUI, then on the MAM GUI Host, open the https port in the firewall for secure browser communication.

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod

[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
-A INPUT -p tcp --dport 443 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod

[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=https/tcp --permanent

[root]# firewall-cmd --reload
```

3. If you are *not* installing the MAM Database on the same host you will install the MAM Server, then on the MAM Database Host, open the postgres port (5432) in the firewall.
   - Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod

[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"
-A INPUT -p tcp --dport 5432 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod

[root]# service iptables save
```

   - Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=postgres/tcp --permanent

[root]# firewall-cmd --reload
```

Install Dependencies, Packages, or Clients

In this section:

Confirm Installation and Initialization of the PostgreSQL Server

Moab Accounting Manager uses a database for transactions and data persistence. The PostgreSQL database may be installed on a separate host

from the MAM Server; however, it is often convenient to install them on the same host.

On the MAM Database Host, confirm PostgreSQL is installed and initialized. See Installing PostgreSQL on page 87.

Install Perl ReadLine (Optional)

Moab Accounting Manager can be optionally configured to provide command history editing functionality in the mam-shell command.

Unlike the other supported OSs, Red Hat 7-based systems do not provide the requisite perl-Term-ReadLine-Gnu package in epel. If you want to use this functionality, you can install the RPM from a reputable third-party rpm site, or install from CPAN per the following example.

- Red Hat 7-based systems

```
[root]# cpan Term::ReadLine::Gnu
```

Configure Moab Accounting Manager

On the MAM Server Host, do the following:

1. As the database user, create a database called `mam` and grant database privileges to the `mam` user.

```
[root]# su - postgres
[postgres]$ psql

create database mam;
create user mam with password 'changeme!';
\q

[postgres]$ exit
```

   The *password* you define must be synchronized with the `database.password` value in `/opt/mam/etc/goldd.conf`

```
[root]# vi /opt/mam/etc/goldd.conf

database.password = changeme!
```

2. Run the `hpc.sql` script to populate the Moab Accounting Manager database with objects, actions, and attributes necessary to function as an Accounting Manager.

```
[root]# su - mam

[mam]$ psql mam < /usr/share/moab-hpc-accounting-manager/8.1.1/hpc.sql
[mam]$ exit
```

3. Start the `mam` service.
   - Red Hat 6-based systems

```
[root]# chkconfig --add mam
[root]# service mam start
```

   - Red Hat 7-based systems

```
[root]# systemctl enable mam.service
[root]# systemctl start mam.service
```

Configure the MAM GUI

If you plan to use the web GUI, then on the MAM GUI Host, do the following:

1. As `root`, add or edit the SSL virtual host definition as appropriate for your environment. To do so, configure the `cgi-bin` directory in `ssl.conf`. Below the `cgi-bin` directory element, create an alias for `/cgi-bin` pointing to your `cgi-bin` directory. If you chose to install to a cgi-bin sub-directory, you might want to create an alias for that as well. Also, add `index.cgi` to the `DirectoryIndex` so you can use the shorter sub-directory name.

```
[root]# vi /etc/httpd/conf.d/ssl.conf

<Directory "/var/www/cgi-bin">
## Add these lines
  Options ExecCGI
  AddHandler cgi-script .cgi
  AllowOverride All
  Order allow,deny
  Allow from all
</Directory>

# Aliases for /cgi-bin
Alias /cgi-bin/ /var/www/cgi-bin/
Alias /mam /var/www/cgi-bin/mam/

# Make shorter sub-dir name available
DirectoryIndex index.cgi
```

2. If Security Enhanced Linux (SELinux) is enforced, you may need to customize SELinux to allow the web server to make network connections, use `setuid` for authentication, and write to the log file.
   a. Determine the current mode of SELinux.

```
[root]# getenforce

Enforcing
```

      - If the command returns a mode of **Disabled** or **Permissive**, or if the `getenforce` command is not found, you can skip the rest of this step.

- If the command returns a mode of **Enforcing**, you can choose between options of customizing SELinux to allow the web GUI to perform its required functions or disabling SELinux on your system.

b. If you choose to customize SELinux, do the following:

> SELinux can vary by version and architecture and that these instructions may not work in all possible environments.

> If you used the `--prefix=<prefix>` configuration option when you configured Moab Accounting Manager, you must replace references to `/opt/mam` in the example below with the <*prefix*> you specified. See Moab Accounting Manager Configuration Options on page 60.

- Red Hat 6-based systems

```
[root]# cat > mamgui.te <<EOF
module mamgui 1.0;
require {
        type httpd_sys_script_t;
        type port_t;
        class capability setuid;
        class tcp_socket name_connect;
}
allow httpd_sys_script_t port_t:tcp_socket name_connect;
allow httpd_sys_script_t self:capability setuid;
EOF
[root]# checkmodule -M -m -o mamgui.mod mamgui.te
[root]# semodule_package -m mamgui.mod -o mamgui.pp
[root]# semodule -i mamgui.pp
[root]# setenforce 0
[root]# chcon -v -t httpd_sys_content_t /opt/mam/log /opt/mam/log/goldg.log*
[root]# setenforce 1
```

- Red Hat 7-based systems

```
[root]# yum install yum install checkpolicy policycoreutils-python
[root]# cat > mamgui.te <<EOF
module mamgui 1.0;
require {
        type httpd_sys_script_t;
        type unreserved_port_t;
        class tcp_socket name_connect;
}
allow httpd_sys_script_t unreserved_port_t:tcp_socket name_connect;
EOF
[root]# checkmodule -M -m -o mamgui.mod mamgui.te
[root]# semodule_package -m mamgui.mod -o mamgui.pp
[root]# semodule -i mamgui.pp
[root]# setenforce 0
[root]# chcon -v -t httpd_sys_rw_content_t /opt/mam/log
/opt/mam/log/goldg.log*
[root]# setenforce 1
```

3. For the highest security, it is recommended that you install a public key certificate that has been signed by a certificate authority. The exact steps to do this are specific to your distribution and the chosen certificate authority.

An overview of this process for CentOS 7 is documented at https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/System_Administrators_Guide/ch-Web_Servers.html#s2-apache-mod_ssl.

Alternatively, if your network domain can be secured from man-in-the-middle attacks, you could use a self-signed certificate. Often this does not require any additional steps since in many distributions, such as Red Hat, the Apache SSL configuration provides self-signed certificates by default.

4. Start or restart the HTTP server daemon.
   - Red Hat 6-based systems

     ```
     [root]# chkconfig httpd on
     [root]# service httpd restart
     ```

   - Red Hat 7-based systems

     ```
     [root]# systemctl enable httpd.service
     [root]# systemctl restart httpd.service
     ```

Access the MAM GUI

If you plan to use the web GUI, then on the MAM Server Host, do the following:

1. Create a password for the `mam` user to be used with the MAM Web GUI.

   ```
   [root]# su - mam
   [mam]$ gchpasswd
   ```

2. Verify the connection.
   a. Open a web browser and navigate to `https://<mam-server-host>/cgi-bin/mam`.
   b. Log in as the `mam` user with the password you set in step 1.

Configure Moab Workload Manager to use Moab Accounting Manager

Do the following, where applicable:

1. On the *Moab* Server Host, edit the Moab configuration file.

   ```
   [root]# vi /opt/moab/etc/moab.cfg
   AMCFG[mam] TYPE=MAM HOST=<mam_server_host>
   ```

   a. Uncomment the AMCFG lines and customize as needed. See Accounting, Charging and Allocation Management in the *Moab Workload Manager Administrator Guide*.

b. If the Moab Server and the MAM Server are on the *same* host, set HOST to 'localhost'; otherwise, set HOST to the host name for the MAM Server (MAM Server Host).

2. If you installed the MAM Server on a *different* host from where the Moab Server is installed, inform Moab of the MAM secrete key.
   a. On the *MAM* Server Host, copy the auto-generated secret key from the `token.value` value in the `/opt/mam/etc/site.conf` file.
   b. On the *Moab* Server Host, add the secrete key to the `moab-private.cfg` file as the value of the CLIENTCFG KEY attribute.

```
[root]# vi /opt/moab/etc/moab-private.cfg

CLIENTCFG[AM:mam] KEY=<MAMSecretKey>
```

3. Restart Moab
   - Red Hat 6-based systems

```
service moab restart
```

   - Red Hat 7-based systems

```
systemctl restart moab.service
```

Initialize Moab Accounting Manager

You will need to initialize Moab Accounting Manager to function in the way that is most applicable to the needs of your site. See **Initial Setup** in the *Moab Accounting Manager Administrator Guide* to set up Moab Accounting Manager for your desired accounting mode.

Related Topics

Installing Moab HPC Suite RPM on page 82

Configuring Moab Web Services

This topic contains instructions on how to configure Moab Web Services (MWS).

In this topic:

Open Necessary Ports

Moab Web Services requires certain ports to be open for essential communication. For communication with the tomcat web server, the default

port is 8080. For communication with the Mongo database, the default port is 27017.

If you have a firewall enabled, do the following:

- Red Hat 6-based systems using iptables

```
[root]# iptables-save > /tmp/iptables.mod
[root]# vi /tmp/iptables.mod

# Add the following lines immediately *before* the line matching
# "-A INPUT -j REJECT --reject-with icmp-host-prohibited"

# Needed on the MWS server for communication with the tomcat web server
-A INPUT -p tcp --dport 8080 -j ACCEPT

# Needed on the Mongo server if installed on a separate host from MWS
-A INPUT -p tcp --dport 27017 -j ACCEPT

[root]# iptables-restore < /tmp/iptables.mod
[root]# service iptables save
```

- Red Hat 7-based systems using firewalld

```
[root]# firewall-cmd --add-port=8080/tcp --permanent
[root]# firewall-cmd --add-port=27017/tcp --permanent
[root]# firewall-cmd --reload
```

Configure Moab Web Services

1. Start Moab.
   - Red Hat 6-based systems

     ```
     [root]# service moab start
     ```

   - Red Hat 7-based systems

     ```
     [root]# systemctl start moab.service
     ```

2. Set up the MWS configuration file.
   a. In the `/opt/mws/etc/mws-config.groovy` file, change these settings:
      - **auth.defaultUser.username**: Any value you like, or leave as is.
      - **auth.defaultUser.password**: Any value you like, but choose a strong password.

```
[root]# vi /opt/mws/etc/mws-config.groovy


// Change these to be whatever you like.
auth.defaultUser.username = "moab-admin"
auth.defaultUser.password = "changeme!"
```

If you do not change **auth.defaultUser.password**, your MWS will not be secure (because anyone reading these instructions would be able to log into your MWS). See tips (http://www.us-cert.gov/cas/tips/ST04-002.html) for choosing a good password.

b. Do *one* of the following:

- If you are configuring an MWS connection to your LDAP server, add the following parameters:

```
ldap.server  = "192.168.0.5"
ldap.port = 389
ldap.baseDNs = ["dc=acme,dc=com"]
ldap.bindUser = "cn=Manager,dc=acme,dc=com"
ldap.password = "*****"
ldap.directory.type = "OpenLDAP Using InetOrgPerson Schema"
```

This is just an example LDAP connection. Be sure to use the appropriate domain controllers (dc) and common names (cn) for your environment.

If you followed the Adaptive Computing tutorial, Setting Up OpenLDAP on CentOS 6 on page 106, your **ldap.directory.type** should be set to "OpenLDAP Using InetOrgPerson Schema." However, the use of other schemas is supported. For more information see **LDAP Configuration Using mws-config.groovy** in the *Moab Web Services Reference Guide*.

To see how to configure a secure connection to the LDAP server, see **Securing the LDAP Connection** in the *Moab Web Services Reference Guide*.

- If you are configuring MWS to use PAM, add the the **pam.configuration.service** parameter to the `mws-config.groovy` file. For example:

```
pam.configuration.service = "login"
```

This is just an example PAM configuration file name. Make sure you specify the name of the configuration file you want MWS to use.

For more information about PAM configuration with MWS, see **PAM (Pluggable Authentication Module) Configuration Using mws-config.groovy** in the *Moab Web Services Reference Guide*.

> There is a security risk when authenticating local users through your PAM configuration. This behavior is highly discouraged and not supported by Adaptive Computing.

> You can configure only one authentication method in `mws-config.groovy`—LDAP or PAM, but not both. If you have configured both LDAP and PAM, MWS defaults to using LDAP.
>
> If you need multiple authentication methods, you must add them to your local PAM configuration. See your distribution documentation for details.

c. Add the **grails.mongo.username** and **grails.mongo.password** parameters to the `mws-config.groovy` file. Use the MWS credentials you added to MongoDB in the Installing Moab HPC Suite RPM on page 82.

```
...
grails.mongo.username = "mws_user"
grails.mongo.password = "secret3"
```

3. Start or restart Tomcat.

   - Red Hat 6-based systems

   ```
   [root]# chkconfig tomcat on
   [root]# service tomcat restart
   ```

   - Red Hat 7-based systems

   ```
   [root]# systemctl enable tomcat.service
   [root]# systemctl restart tomcat.service
   ```

4. Navigate to `http://<localhost>:8080/mws/` in a web browser to verify that MWS is running (you will see some sample queries and a few other actions).

5. Log in to MWS to verify that your credentials are working. (Your login credentials are the `auth.defaultUser.username` and `auth.defaultUser.password` values you set in the `/opt/mws/etc/mws-config.groovy` file.)

If you encounter problems, or if the application does not seem to be running, see the steps in Moab Web Services Issues on page 139.

Related Topics

- Installing Moab HPC Suite RPM on page 82

Additional Configuration

In this section:

Configuring SSL in Tomcat

To configure SSL in Tomcat, please refer to the Apache Tomcat documentation.

Setting Up OpenLDAP on CentOS 6

These instructions are intended to help first-time LDAP administrators get up and running. The following procedures contain instructions for getting started using OpenLDAP on a CentOS 6 system. For more complete information on how to set up OpenLDAP see the OpenLDAP documentation (http://www.openldap.org/doc/admin24/).

In this topic:

Adaptive Computing is not responsible for creating, maintaining, or supporting customer LDAP or Active Directory configurations.

Installing and Configuring OpenLDAP on Centos 6

First, you will need to install OpenLDAP. These instructions explain how you can do this on a CentOS 6 system.

To install and configure OpenLDAP on Centos 6

1. Run the following command:

```
[root]# yum -y install openldap openldap-clients openldap-servers
```

2. Generate a password hash to be used as the admin password. This password hash will be used when you create the root user for your LDAP installation. For example:

```
[root]# slappasswd
New password : p@ssw0rd
Re-enter new password : p@ssw0rd
{SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
```

3. Add the root user and the root user's password hash to the OpenLDAP configuration in the `olcDatabase={2}bdb.ldif` file. The root user will have permissions to add other users, groups, organizational units, etc. Do the following:

   a. Run this command:

```
[root]# cd /etc/openldap/slapd.d/cn\=config
[root]# vi olcDatabase\=\{2\}bdb.ldif
```

   b. If the **olcRootPW** attribute does not already exist, create it. Then set the value to be the hash you created from `slappasswd`. For example:

```
olcRootPW: {SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
...
```

4. While editing this file, change the distinguished name (DN) of the **olcSuffix** to something appropriate. The suffix typically corresponds to your DNS domain name, and it will be appended to the DN of every other LDAP entry in your LDAP tree.

   For example, let's say your company is called Acme Corporation, and that your domain name is "acme.com." You might make the following changes to the `olcDatabase={2}bdb.ldif` file:

```
olcSuffix: dc=acme,dc=com
...
olcRootDN: cn=Manager,dc=acme,dc=com
...
olcRootPW: {SSHA}5lPFVw19zeh7LT53hQH69znzj8TuBrLv
...
```

Throughout the following examples in this topic, you will see `dc=acme,dc=com`. "acme" is only used as an example to illustrate what you would use as your own domain controller if your domain name was "acme.com." You should replace any references to "acme" with your own organization's domain name.

Do not set the cn of your root user to "root" (`cn=root,dc=acme,dc=com`), or OpenLDAP will have problems.

5. Modify the DN of the root user in the `olcDatabase={1}monitor.ldif` file to match the **olcRootDN** line in the `olcDatabase={2}bdb.ldif` file. Do the following:

   a. Run this command to edit the `olcDatabase={2}bdb.ldif` file:

   ```
   [root]# vi olcDatabase\=\{1\}monitor.ldif
   ```

   b. Modify the **olcAccess** line so that the **dn.base** matches the **olcRootDN** from the `olcDatabase={2}bdb.ldif` file. (In this example, **dn.base** should be "cn=Manager,dc=acme,dc=com".)

   ```
   olcAccess: {0}to * by
   dn.base="gidNumber=0+uidNumber=0,cn=peercred,cn=external,cn=auth" read by
   dn.base="cn=Manager,dc=acme,dc=com" read by * none
   ```

   c. Now the root user for your LDAP is `cn=Manager,dc=acme,dc=com`. The root user's password is the password that you entered using `slappasswd` (see step 2), which, in this example, is **p@ssw0rd**

6. Hide the password hashes from users who should not have permission to view them.

   > A full discussion on configuring access control in OpenLDAP is beyond the scope of this tutorial. For help, see the OpenLDAP Access Control documentation (http://www.openldap.org/doc/admin24/access-control.html).

   a. Run this command to edit the `oclDatabase\=\{2\}bdb.ldif` file:

   ```
   [root]# vi olcDatabase\=\{2\}bdb.ldif
   ```

   b. Add the following two lines to the end of the file to restrict users from viewing other users' password hashes.

   ```
   olcAccess: {0}to attrs=userPassword by self write by
   dn.base="cn=Manager,dc=acme,dc=com" write by anonymous auth by * none
   olcAccess: {1}to * by dn.base="cn=Manager,dc=acme,dc=com" write by self write by
   * read
   ```

   These lines allow a user to read and write his or her own password. It also allows a manager to read and write anyone's password. Anyone, including anonymous users, is allowed to view non-password attributes of other users.

7. Make sure that OpenLDAP is configured to start when the machine starts up, and start the OpenLDAP service.

   ```
   [root]# chkconfig slapd on
   [root]# service slapd start
   ```

8. Now, you must manually create the "dc=acme,dc=com" LDAP entry in your LDAP tree.

An LDAP directory is analogous to a tree. Nodes in this tree are called LDAP "entries" and may represent users, groups, organizational units, domain controllers, or other objects. The attributes in each entry are determined by the LDAP schema. In this tutorial we will build entries based on the InetOrgPerson schema (which ships with OpenLDAP by default).

In order to build our LDAP tree we must first create the root entry. Root entries are usually a special type of entry called a domain controller (DC). Because we are assuming that the organization is called Acme Corporation, and that the domain is "acme.com," we will create a domain controller LDAP entry called `dc=acme,dc=com`. Again, you will need to replace "acme" with your organization's domain name. Also note that `dc=acme,dc=com` is what is called an LDAP distinguished name (DN). An LDAP distinguished name uniquely identifies an LDAP entry.

Do the following:

a. Create a file called `acme.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi acme.ldif
```

b. Add the following lines in `acme.ldif`:

```
dn: dc=acme,dc=com
objectClass: dcObject
objectClass: organization
dc: acme
o : acme
```

c. Now add the contents of this file to LDAP. Run this command:

```
[root]# ldapadd -f acme.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

d. Verify that your entry was added correctly.

```
[root]# ldapsearch -x -LLL -b dc=acme,dc=com
dn: dc=acme,dc=com
objectClass: dcObject
objectClass: organization
dc: acme
o: acme
```

9. Run the following:

```
[root]# sudo iptables -L
[root]# sudo service iptables save
```

10. By default, the CentOS 6 firewall will block external requests to OpenLDAP. In order to allow MWS to access LDAP, you will have to configure your firewall to allow connections on port 389. (Port 389 is the default LDAP port.)

Configuring your firewall is beyond the scope of this tutorial; however, it may be helpful to know that the default firewall on CentOS is a service called `iptables`. (For more information, see the documentation on iptables.) In the most basic case, you may be able to add a rule to your firewall that accepts connections to port 389 by doing the following:

a. Edit your `iptables` file:

```
[root]# vi /etc/sysconfig/iptables
```

b. Add the following line *after* all the **ACCEPT** lines but *before* any of the **REJECT** lines in your `iptables` file:

```
# ... lines with ACCEPT should be above
-A INPUT -p tcp --dport 389 -j ACCEPT
# .. lines with REJECT should be below
```

For example, here is a sample `iptables` file with this line added:

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 22 -j ACCEPT
-A INPUT -p tcp --dport 389 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -j REJECT --reject-with icmp-host-prohibited

COMMIT
```

c. Now reload `iptables`.

```
[root]# service iptables reload
```

Although providing instructions is beyond the scope of this tutorial, it is also highly recommended that you set up OpenLDAP to use SSL or TLS security to prevent passwords and other sensitive data from being sent in plain text. For information on how to do this, see the OpenLDAP TLS documentation (http://www.openldap.org/doc/admin24/tls.html).

Now that you have installed and set up Open LDAP, you are ready to add organizational units. See Adding an Organizational Unit (OU) on page 110.

Adding an Organizational Unit (OU)

These instructions will describe how to populate the LDAP tree with organizational units (OUs), groups, and users, all of which are different types of LDAP entries. The examples that follow also presume an InetOrgPerson schema, because the InetOrgPerson schema is delivered with OpenLDAP by default.

To add an organizational unit (OU) entry to the LDAP tree

In this example, we are going to add an OU called "Users."

1. Create a temporary file called `users.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi users.ldif
```

2. Add these lines to `users.ldif`:

```
dn: ou=Users,dc=acme,dc=com
objectClass: organizationalUnit
ou: Users
```

3. Add the contents of `users.ldif` file to LDAP.

```
[root]# ldapadd -f users.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a User

To add a user to LDAP

In this example, we will add a user named "Bob Jones" to LDAP inside the "Users" OU.

1. Create a temporary file called `bob.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi bob.ldif
```

2. Add these lines to `bob.ldif`:

```
dn: cn=Bob Jones,ou=Users,dc=acme,dc=com
cn: Bob Jones
sn: Jones
objectClass: inetOrgPerson
userPassword: p@ssw0rd
uid: bjones
```

3. Add the contents of `bob.ldif` file to LDAP.

```
[root]# ldapadd -f bob.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a Group

To add a group to LDAP

In this example, we will add a group called "Engineering" to LDAP inside the "Users" OU.

1. Create a temporary file called `engineering.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi engineering.ldif
```

2. Add these lines to `engineering.ldif`:

```
dn: cn=Engineering,ou=Users,dc=acme,dc=com
cn: Engineering
objectClass: groupOfNames
member: cn=Bob Jones,ou=Users,dc=acme,dc=com
```

3. Add the contents of `engineering.ldif` file to LDAP.

```
[root]# ldapadd -f engineering.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Adding a User to a Group

To add a user to an LDAP group

In this example, we will add an LDAP member named "Al Smith" to the "Engineering" LDAP group. This example assumes that user, Al Smith, has already been added to LDAP.

> Before you add a user to an LDAP group, the user must first be added to LDAP. For more information, see Adding a User on page 111.

1. Create a temporary file called `addUserToGroup.ldif`. (You can delete this file once its content has been added to LDAP, so in this example, we will create it in the `/tmp` folder.)

```
[root]# cd /tmp
[root]# vi addUserToGroup.ldif
```

2. Add these lines to `addUserToGroup.ldif`:

```
dn: cn=Engineering,ou=Users,dc=acme,dc=com
changetype: modify
add: member
member: cn=Al Smith,ou=Users,dc=acme,dc=com
```

3. Now add the contents of `addUserToGroup.ldif` file to LDAP.

```
[root]# ldapadd -f addUserToGroup.ldif -D cn=Manager,dc=acme,dc=com -w p@ssw0rd
```

Trusting Servers in Java

Prerequisites

Some of these instructions refer to `JAVA_HOME`, which must point to the same directory that Tomcat uses. To set `JAVA_HOME`, do this:

```
[root]# source /etc/tomcat6/tomcat6.conf
```

Your system administrator might have defined Tomcat's `JAVA_HOME` in a different file.

Retrieve the Server's X.509 Public Certificate

To retrieve the server's certificate, use the following command:

```
[root]# $JAVA_HOME/bin/keytool -printcert -rfc -sslserver <servername>:<port> >
/tmp/public.cert.pem
```

Replace *<servername>* with the server's host name and *<port>* with the secure port number. The default port for https is 443. The default port for ldaps is 636. If successful, `/tmp/public.cert.pem` contains the server's public certificate. Otherwise, `/tmp/public.cert.pem` contains an error message. This message is typical: `keytool error: java.lang.Exception: No certificate from the SSL server`. This message suggests that the server name or port is incorrect. Consult your IT department to determine the correct server name and port.

Add the Server's Certificate to Java's Keystore

Java stores trusted certificates in a database known as the keystore. Because each new version of Java has its own keystore, you need to add the server certificate to the Java keystore (using the steps below) every time you install a new version of Java.

Java's keystore is located at `$JAVA_HOME/lib/security/cacerts`. If Tomcat's `JAVA_HOME` points to a JDK, then the keystore is located at `$JAVA_HOME/jre/lib/security/cacerts`. To add the server certificate to the keystore, run the following command:

```
[root]# $JAVA_HOME/bin/keytool -import -trustcacerts -file /tmp/public.cert.pem -alias
<servername> -keystore $JAVA_HOME/lib/security/cacerts
```

You will be prompted for the keystore password, which is "changeit" by default.

> Your system administrator might have changed this password.

After you've entered the keystore password, you'll see the description of the server's certificate. At the end of the description it prompts you to trust the certificate.

```
Trust this certificate? [no]:
```

Type `yes` and press **Enter** to add the certificate to the keystore.

Upgrade

In this section:

Upgrading Moab HPC Suite from 8.0 or later

If using Moab Accounting Manager, this upgrade will result in the creation of a new mam user. This new mam user will replace the moab user as the primary MAM Accounting Admin. Moab Accounting Manager files and directories will be changed to be owned by this new user as part of the upgrade process.

Because many system-level files and directories are accessed during the installation, the instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

To Upgrade the RPM Suite

1. Shut down all Adaptive services.

```
[root]# service moab stop        # you can also run mschedctl -k
[root]# service mam stop         # If running mam on the head node
[root]# service tomcat6 stop
[root]# service pbs_server stop
[root]# service pbs_mom stop     # if running pbs_mom on the head node
[root]# service trqauthd stop
```

2. Download the latest 8.1.1 build executable (`moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz`, for example) from the Adaptive Computing website.
3. Untar the package.

```
[root]# tar xzf moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz
```

4. Change directories into the root directory of the untarred directory.

   > Consider reviewing the README file for additional details on using the RPM distribution tarball.

5. Install the suite repositories.

   ```
   [root]# ./install-rpm-repos.sh [repository-directory] -y
   ```

   > The `-y` option will install with the default settings for the RPM suite.

   > The installation returns the following warning line:
   >
   > `Warning: RPMDB altered outside of yum.`
   >
   > This is normal and can safely be ignored.

   The *[<repository-directory>]* option is the directory where you want to copy the RPMs. If no argument is given, *[<repository-directory>]* defaults to `/opt/adaptive-rpm-repository/rpm`. If the *[<repository-directory>]* already exists, RPMs will be added to the existing directory. No files are overwritten in *[<repository-directory>]*. A repository file is also created in `/etc/yum.repos.d/` and points to the *[<repository-directory>]* location.

   For ease in repository maintenance, the install script fails if Adaptive Computing RPMs are copied to different directories. If a non-default *[<repository-directory>]* is specified, please use the same directory for future updates.

   The script installs the `createrepo` package and its dependencies. You must answer "y" to all the questions in order for the RPM install to work. Additionally, the script installs the EPEL and 10gen repositories.

6. Merge the new `.repo` files in `/etc/yum.repos.d/` with the existing ones.

   The `install-rpm-repos.sh` script will not overwrite existing RPM, GPG key or `.repo` files. Because some `.repo` files may have changed from previous releases, some merging of the `.repo` files is necessary. The newest files will have the `.new` extension.

   Please compare older `.repo` files with the newer ones to ensure that the latest changes are reflected. In some cases, there is no change, and you can remove the new file. In most cases, however, it is safe to overwrite the old `.repo` file with the new one. For example:

   ```
   [root]# mv /etc/yum.repos.d/AC.repo.new /etc/yum.repos.d/AC.repo
   ```

   After making changes in the `/etc/yum.repos.d` directory, make sure to run the following command to update the `yum` cache:

```
[root]# yum clean all
```

7. Update the 8.1.1 suite packages.

```
[root]# yum update moab*
```

> The Moab and MWS RPMs automatically create a backup of all relevant files. These backups are stored in `/var/tmp/backup-<rpmName>-<timestamp>.tar.gz`.
>
> If changes are detected between any existing configuration files and new configuration files, a version of the new configuration file will be saved under `<configurationFileLocation>/<fileName>.rpmnew`.

8. If you use ODBC, you must upgrade to the 8.1.1 schema. See **Migrating Your Database to Newer Versions of Moab** in the *Moab Workload Manager Administrator Guide* for more information.
9. Adaptive Computing recommends MongoDB version 2.4.x. Support for environments using 2.0 is now deprecated and will be removed in a future release. If you are running a MongoDB version less than 2.4.x, see Upgrading from MongoDB 2.0 to 2.4.x on page 131 for instructions.
10. Upgrade the schema of the `mws` database in MongoDB.

> You *must* perform this step, regardless of whether you upgraded MongoDB to version 2.4.x or not. (See previous step.)

> Before updating this database, you should perform a full backup. This can be done by using the `mongodump` utility documented in the MongoDB documentation (http://www.mongodb.org/display/DOCS/Backups).

Run the database migration script provided with MWS. (It is safe to run this script more than once. If for any reason, errors occur during the execution of the script, run it again.)

```
[root]# mongo -u mws_user mws /opt/mws/utils/db-migrate.js -p
```

> You may be prompted for the mongo password. The password can be found in the /opt/mws/etc/mws-config.groovy file under the "grails.mongo.password" key.

> Depending on the number of events and services in the system, the script may take several minutes to execute.

11. (Optional, but recommended for MWS) Upgrade to Java 7.

Oracle Java 7 Runtime Environment is the recommended Java environment, but Java 6 is also supported. All other versions of Java, including OpenJDK/IcedTea, GNU Compiler for Java, etc. cannot run Moab Web Services.

The Oracle® Java® download page has moved and requires a web-enabled workstation to accept the license agreement and download the software.

Do the following:

a. Download Java 7 on a web-enabled workstation.
   i. Open a web browser and connect to the Java downloads page (http://www.oracle.com/technetwork/java/javase/downloads/jre7-downloads-1880261.html).
   ii. Select the radio button to accept the license agreement.
   iii. Click the download link for the Linux x64 RPM file.
b. Copy the Java 7 RPM to the MWS server using scp, rsync, or any similar network copy utility.
c. On the MWS server, run the following to install Java 7:

```
[root]# rpm -Uh <RPMfilename>
```

12. Merge the configuration files.

Whether or not to start with the old configuration file and add newer configuration options (or vice versa) depends on the amount of customization you previously made in earlier versions. In instances where you have modified very little, you should consider using the newer configuration and merging site-specific settings from the old file into the new one. The following steps highlight important changes between the 7.2.x default configuration and the 8.1.1 default configuration. Also note that new configuration files may have auto-generated content for secret keys and default passwords—be careful to ensure that secret keys shared between components are configured correctly.

The recommended layout for the `/opt/moab/etc/` directory appears as follows:

```
[root]# ls -l /opt/moab/etc
total 29
-rw-r--r--. 1 root moab  2323 Nov 13 13:41 config.moab.pl
-rw-r--r--. 1 root moab   989 Nov 13 13:41 config.sql.pl
lrwxrwxrwx. 1 root root    14 Nov 13 15:46 moab.cfg -> moab.hpc.cfg
-rw-r--r--. 1 root moab 23500 Nov 13 15:43 moab.hpc.cfg
drwxr-xr-x. 2 root moab  4096 Nov 13 15:41 moab.d
-rw-r--r--. 1 root moab   391 Nov 13 13:41 moab.dat
-r--r--r--. 1 root root   493 Nov  6 16:14 moab.lic
-rw-------. 1 root moab   288 Nov 13 15:39 moab-private.cfg
lrwxrwxrwx. 1 root root    14 Nov 13 15:46 nami.cfg -> nami.hpc.cfg
-rw-r--r--. 1 root moab   563 Nov 13 15:43 nami.hpc.cfg
```

Do the following:

a. Merge the `/opt/moab/etc/moab-private.cfg` file. Make sure that unique items in `/opt/moab/etc/moab-private.cfg.rpmnew` are added to the existing `/opt/moab/etc/moab-private.cfg` file. Include the new MWS RM credentials if you configure MWS as a resource manager:

```
CLIENTCFG[RM:mws] USERNAME=moab-admin PASSWORD=changeme!
```

The default MWS credentials in 7.2.x were *admin:adminpw*. For releases after 7.2.x, the default credentials were changed to *moab-admin:changeme!*. Use whatever credentials you have configured in `/opt/mws/etc/mws-config.groovy`.

b. Merge customizations from `/opt/moab/etc/moab.cfg` and `/opt/moab/etc/moab.d/*` into `/opt/moab/etc/moab.hpc.cfg`.

Although there are several ways to configure and merge changes into the `/opt/moab/etc/moab.cfg` file, the following instructions outline the recommended best practices. *Deviations from these best practices may result in unexpected behavior or added difficulty in future upgrades.*

It is best to use the new default configuration file (`/opt/moab/etc/moab.hpc.cfg`) and merge changes from previous files into that one. You will notice that content from the `/opt/moab/etc/moab.d/` directory has been merged into `/opt/moab/etc/moab.hpc.cfg`. Ensure that custom configuration options in all files located in `/opt/moab/etc/moab.d/` directory get merged in to `/opt/moab/etc/moab.hpc.cfg`.

You should avoid `#include` configurations.

Although the upgrade should have created a backup of the `moab.cfg` file (in `/var/tmp/backup-<rpmName>-<timestamp>.tar.gz`), it is best to

create your own backup until you can confirm the updated configuration behaves as expected.

```
[root]# cp /opt/moab/etc/moab.cfg /opt/moab/etc/moab.cfg.bak
```

c. Merge the `/opt/mws/etc/mws-config.groovy` file.

Merge the `/opt/mws/etc/mws-config.groovy.rpmnew` file with the old `/opt/mws/etc/mws-config.groovy` file by editing `/opt/mws/etc/mws-config.groovy`. (Note the addition of the "auditAppender" in the default logging configuration of `/opt/mws/etc/mws-config.groovy.rpmnew`.)

```
moab.messageQueue.port = 5570

log4j = {
  // Configure an appender for the events log.
  def eventAppender = new org.apache.log4j.rolling.RollingFileAppender(
    name: 'events', layout: pattern(conversionPattern: "%m%n"))
  def rollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
    fileNamePattern: '/opt/mws/log/events.%d{yyyy-MM-dd}',
    activeFileName: '/opt/mws/log/events.log')
  rollingPolicy.activateOptions()
  eventAppender.setRollingPolicy(rollingPolicy)

  // Configure an appender for the audit log.
  def auditAppender = new org.apache.log4j.rolling.RollingFileAppender(
      name: 'audit',
      layout: new com.ace.mws.logging.ACPatternLayout("%j\t\t\t%c{1}
\t\t\t%m%n"))
  def auditRollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
      fileNamePattern: '/opt/mws/log/audit.%d{yyyy-MM-dd}',
      activeFileName: '/opt/mws/log/audit.log')
  auditRollingPolicy.activateOptions()
  auditAppender.setRollingPolicy(auditRollingPolicy)

  appenders {
    rollingFile name: 'stacktrace',
        file: '/opt/mws/log/stacktrace.log',
        maxFileSize: '100MB'
    rollingFile name: 'rootLog',
        file: '/opt/mws/log/mws.log',
        maxFileSize: '100MB', //The maximum file size for a single log file
        maxBackupIndex: 10, //Retain only the 10 most recent log files, delete
older logs to save space
        ~~layout:pattern(conversionPattern: '%d %p %c %m%n'), //Configures the
output format of each log entry~~
        layout: new com.ace.mws.logging.ACPatternLayout(), //Configures the
output format of each log entry
        threshold: org.apache.log4j.Level.ERROR //Ignore any logging entries
less verbose than this threshold

    appender eventAppender
    appender auditAppender
  }

  // NOTE: This definition is a catch-all for any logger not defined below
  root {
    error 'rootLog'
  }

  // Individual logger configurations
  ...

  // Logs event information to the events log, not the rootLog
  trace additivity:false, events:'com.ace.mws.events.EventFlatFileWriter'
  // Logs audit information to the audit log, not the rootLog
  trace additivity:false, audit:'mws.audit'
                                        }
```

Additions are noted in red. Removed content is stricken out.

Note that the **mws.suite** parameter and the **mam.*** parameters have been moved to a suite-specific file in `/opt/mws/etc/mws.d/` and do not need to exist in `/opt/mws/etc/mws-config.groovy`.

Also note the new ***messageQueue** parameters in `/opt/mws/etc/mws-config.groovy.rpmnew`. These are required and the **moab.messageQueue.secretKey** value should match the value located in `/opt/moab/etc/moab-private.cfg`.

13. If you are using Moab Accounting Manager, do the following:
    a. Add the new mam user as a MAM Accounting Admin.

```
[root]# su -c "gmkuser -u mam -d \"Accounting Admin\"" moab
[root]# su -c "gchrole -r SystemAdmin --add-user mam" moab
[root]# perl -p -i -e 's/moab/mam/ if /^super.user/' /opt/mam/etc/goldd.conf
```

    b. Migrate the Moab Accounting Manager database from your current version to 8.1, running the migration script. The migration scripts are located in the `/usr/share/moab-hpc-accounting-manager/8.1.1/` directory.

> The migration script must be run as the user that is running the mam service.

        i. Start the mam service and determine the user running the goldd process. User "mam" is running goldd in the following example.

```
[root]# service mam start
[root]# ps -ef | grep goldd
mam      25274     1  0 Jan12 ?        00:00:01 /usr/bin/perl -w
/opt/mam/sbin/goldd
```

        ii. Run the migration script as the user running the mam service.

```
[root]# su -c /usr/share/moab-hpc-accounting-manager/8.1.1/migrate_8.0-
8.1.pl mam
```

14. Start all Adaptive services.

```
[root]# service pbs_server start
[root]# service moab start
[root]# service tomcat6 start
[root]# service pbs_mom start      # if running pbs_mom on the head node
[root]# service trqauthd start
```

Upgrading Moab HPC Suite from 7.2

If using Moab Accounting Manager, this upgrade will result in the creation of a new mam user. This new mam user will replace the moab user as the primary MAM Accounting Admin. Moab Accounting Manager files and directories will be changed to be owned by this new user as part of the upgrade process.

If using Moab Web Services, this upgrade removes all MWS roles and permissions and recreates the default roles. If you have modified any MWS permissions or roles, you will need to recreate them after the upgrade is complete.

Because many system-level files and directories are accessed during the installation, the instructions in this guide should be executed with root privileges.

You will see that the instructions execute commands as the root user. Please note that the same commands will work for a non-root user with the `sudo` command.

To Upgrade the RPM Suite

1. Shut down all Adaptive services.

```
[root]# service moab stop        # you can also run mschedctl -k
[root]# service mam stop         # If running mam on the head node
[root]# service tomcat6 stop
[root]# service pbs_server stop
[root]# service pbs_mom stop     # if running pbs_mom on the head node
[root]# service trqauthd stop
```

2. Download the latest 8.1.1 build executable (`moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz`, for example) from the Adaptive Computing website.
3. Untar the package.

```
[root]# tar xzf moab-hpc-enterprise-suite-<version>-<timestamp>-<OS>.tar.gz
```

4. Change directories into the root directory of the untarred directory.

   Consider reviewing the README file for additional details on using the RPM distribution tarball.

5. Install the suite repositories.

```
[root]# ./install-rpm-repos.sh [repository-directory] -y
```

> The `-y` option will install with the default settings for the RPM suite.

> The installation returns the following warning line:
>
> `Warning: RPMDB altered outside of yum.`
>
> This is normal and can safely be ignored.

The *[<repository-directory>]* option is the directory where you want to copy the RPMs. If no argument is given, *[<repository-directory>]* defaults to `/opt/adaptive-rpm-repository/rpm`. If the *[<repository-directory>]* already exists, RPMs will be added to the existing directory. No files are overwritten in *[<repository-directory>]*. A repository file is also created in `/etc/yum.repos.d/` and points to the *[<repository-directory>]* location.

For ease in repository maintenance, the install script fails if Adaptive Computing RPMs are copied to different directories. If a non-default *[<repository-directory>]* is specified, please use the same directory for future updates.

The script installs the `createrepo` package and its dependencies. You must answer "y" to all the questions in order for the RPM install to work. Additionally, the script installs the EPEL and 10gen repositories.

6. Merge the new `.repo` files in `/etc/yum.repos.d/` with the existing ones.

   The `install-rpm-repos.sh` script will not overwrite existing RPM, GPG key or `.repo` files. Because some `.repo` files may have changed from previous releases, some merging of the `.repo` files is necessary. The newest files will have the `.new` extension.

   Please compare older `.repo` files with the newer ones to ensure that the latest changes are reflected. In some cases, there is no change, and you can remove the new file. In most cases, however, it is safe to overwrite the old `.repo` file with the new one. For example:

   ```
   [root]# mv /etc/yum.repos.d/AC.repo.new /etc/yum.repos.d/AC.repo
   ```

   After making changes in the `/etc/yum.repos.d` directory, make sure to run the following command to update the `yum` cache:

   ```
   [root]# yum clean all
   ```

7. Update the 8.1.1 suite packages.

   ```
   [root]# yum update moab*
   ```

> The Moab and MWS RPMs automatically create a backup of all relevant files. These backups are stored in `/var/tmp/backup-<rpmName>-<timestamp>.tar.gz`.
>
> If changes are detected between any existing configuration files and new configuration files, a version of the new configuration file will be saved under `<configurationFileLocation>/<fileName>.rpmnew`.

8. If you use ODBC, you must upgrade to the 8.1.1 schema. See **Migrating Your Database to Newer Versions of Moab** in the *Moab Workload Manager Administrator Guide* for more information.
9. Adaptive Computing recommends MongoDB version 2.4.x. Support for environments using 2.0 is now deprecated and will be removed in a future release. If you are running a MongoDB version less than 2.4.x, see Upgrading from MongoDB 2.0 to 2.4.x on page 131 for instructions.
10. Upgrade the schema of the `mws` database in MongoDB.

    > You *must* perform this step, regardless of whether you upgraded MongoDB to version 2.4.x or not. (See previous step.)

    > Before updating this database, you should perform a full backup. This can be done by using the `mongodump` utility documented in the MongoDB documentation (http://www.mongodb.org/display/DOCS/Backups).

    Run the database migration script provided with MWS. (It is safe to run this script more than once. If for any reason, errors occur during the execution of the script, run it again.)

    ```
    [root]# mongo -u mws_user mws /opt/mws/utils/db-migrate.js -p
    ```

    > You may be prompted for the mongo password. The password can be found in the /opt/mws/etc/mws-config.groovy file under the "grails.mongo.password" key.

    > Depending on the number of events and services in the system, the script may take several minutes to execute.

11. (Optional, but recommended for MWS) Upgrade to Java 7.

Oracle Java 7 Runtime Environment is the recommended Java environment, but Java 6 is also supported. All other versions of Java, including OpenJDK/IcedTea, GNU Compiler for Java, etc. cannot run Moab Web Services.

The Oracle® Java® download page has moved and requires a web-enabled workstation to accept the license agreement and download the software.

Do the following:

a. Download Java 7 on a web-enabled workstation.
   i. Open a web browser and connect to the Java downloads page (http://www.oracle.com/technetwork/java/javase/downloads/jre7-downloads-1880261.html).
   ii. Select the radio button to accept the license agreement.
   iii. Click the download link for the Linux x64 RPM file.
b. Copy the Java 7 RPM to the MWS server using scp, rsync, or any similar network copy utility.
c. On the MWS server, run the following to install Java 7:

```
[root]# rpm -Uh <RPMfilename>
```

12. Merge the configuration files.

Whether or not to start with the old configuration file and add newer configuration options (or vice versa) depends on the amount of customization you previously made in earlier versions. In instances where you have modified very little, you should consider using the newer configuration and merging site-specific settings from the old file into the new one. The following steps highlight important changes between the 7.2.x default configuration and the 8.1.1 default configuration. Also note that new configuration files may have auto-generated content for secret keys and default passwords—be careful to ensure that secret keys shared between components are configured correctly.

The recommended layout for the /opt/moab/etc/ directory appears as follows:

```
[root]# ls -l /opt/moab/etc
total 29
-rw-r--r--. 1 root moab  2323 Nov 13 13:41 config.moab.pl
-rw-r--r--. 1 root moab   989 Nov 13 13:41 config.sql.pl
lrwxrwxrwx. 1 root root    14 Nov 13 15:46 moab.cfg -> moab.hpc.cfg
-rw-r--r--. 1 root moab 23500 Nov 13 15:43 moab.hpc.cfg
drwxr-xr-x. 2 root moab  4096 Nov 13 15:41 moab.d
-rw-r--r--. 1 root moab   391 Nov 13 13:41 moab.dat
-r--r--r--. 1 root root   493 Nov  6 16:14 moab.lic
-rw-------. 1 root moab   288 Nov 13 15:39 moab-private.cfg
lrwxrwxrwx. 1 root root    14 Nov 13 15:46 nami.cfg -> nami.hpc.cfg
-rw-r--r--. 1 root moab   563 Nov 13 15:43 nami.hpc.cfg
```

Do the following:

a. Merge the /opt/moab/etc/moab-private.cfg file. Make sure that unique items in /opt/moab/etc/moab-private.cfg.rpmnew are added to the existing /opt/moab/etc/moab-private.cfg file. Include the new MWS RM credentials if you configure MWS as a resource manager:

```
CLIENTCFG[RM:mws] USERNAME=moab-admin PASSWORD=changeme!
```

The default MWS credentials in 7.2.x were *admin:adminpw*. For releases after 7.2.x, the default credentials were changed to *moab-admin:changeme!*. Use whatever credentials you have configured in /opt/mws/etc/mws-config.groovy.

b. Merge customizations from /opt/moab/etc/moab.cfg and /opt/moab/etc/moab.d/* into /opt/moab/etc/moab.hpc.cfg.

Although there are several ways to configure and merge changes into the /opt/moab/etc/moab.cfg file, the following instructions outline the recommended best practices. *Deviations from these best practices may result in unexpected behavior or added difficulty in future upgrades.*

It is best to use the new default configuration file (/opt/moab/etc/moab.hpc.cfg) and merge changes from previous files into that one. You will notice that content from the /opt/moab/etc/moab.d/ directory has been merged into /opt/moab/etc/moab.hpc.cfg. Ensure that custom configuration options in all files located in /opt/moab/etc/moab.d/ directory get merged in to /opt/moab/etc/moab.hpc.cfg.

You should avoid #include configurations.

Although the upgrade should have created a backup of the moab.cfg file (in /var/tmp/backup-*<rpmName>*-*<timestamp>*.tar.gz), it is best to

create your own backup until you can confirm the updated configuration behaves as expected.

```
[root]# mv /opt/moab/etc/moab.cfg /opt/moab/etc/moab.hpc.cfg.bak
```

Once the changes have been merged to `/opt/moab/etc/moab.hpc.cfg`, configure Moab to use the new file. The recommended configuration is to use a symlink called `/opt/moab/etc/moab.cfg` that points to `/opt/moab/etc/moab.hpc.cfg`.

```
[root]# ln -s /opt/moab/etc/moab.hpc.cfg /opt/moab/etc/moab.cfg
```

c. Merge the `/opt/mws/etc/mws-config.groovy` file.

Merge the `/opt/mws/etc/mws-config.groovy.rpmnew` file with the old `/opt/mws/etc/mws-config.groovy` file by editing `/opt/mws/etc/mws-config.groovy`. (Note the addition of the "auditAppender" in the default logging configuration of `/opt/mws/etc/mws-config.groovy.rpmnew`.)

```
moab.messageQueue.port = 5570

log4j = {
  // Configure an appender for the events log.
  def eventAppender = new org.apache.log4j.rolling.RollingFileAppender(
    name: 'events', layout: pattern(conversionPattern: "%m%n"))
  def rollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
    fileNamePattern: '/opt/mws/log/events.%d{yyyy-MM-dd}',
    activeFileName: '/opt/mws/log/events.log')
  rollingPolicy.activateOptions()
  eventAppender.setRollingPolicy(rollingPolicy)

  // Configure an appender for the audit log.
  def auditAppender = new org.apache.log4j.rolling.RollingFileAppender(
      name: 'audit',
      layout: new com.ace.mws.logging.ACPatternLayout("%j\t\t\t%c{1}
\t\t\t%m%n"))
  def auditRollingPolicy = new org.apache.log4j.rolling.TimeBasedRollingPolicy(
      fileNamePattern: '/opt/mws/log/audit.%d{yyyy-MM-dd}',
      activeFileName: '/opt/mws/log/audit.log')
  auditRollingPolicy.activateOptions()
  auditAppender.setRollingPolicy(auditRollingPolicy)

  appenders {
    rollingFile name: 'stacktrace',
        file: '/opt/mws/log/stacktrace.log',
        maxFileSize: '100MB'
    rollingFile name: 'rootLog',
        file: '/opt/mws/log/mws.log',
        maxFileSize: '100MB', //The maximum file size for a single log file
        maxBackupIndex: 10, //Retain only the 10 most recent log files, delete
older logs to save space
        ~~layout:pattern(conversionPattern: '%d %p %c %m%n'), //Configures the
output format of each log entry~~
        layout: new com.ace.mws.logging.ACPatternLayout(), //Configures the
output format of each log entry
        threshold: org.apache.log4j.Level.ERROR //Ignore any logging entries
less verbose than this threshold

    appender eventAppender
    appender auditAppender
  }

  // NOTE: This definition is a catch-all for any logger not defined below
  root {
    error 'rootLog'
  }

  // Individual logger configurations
  ...

  // Logs event information to the events log, not the rootLog
  trace additivity:false, events:'com.ace.mws.events.EventFlatFileWriter'
  // Logs audit information to the audit log, not the rootLog
  trace additivity:false, audit:'mws.audit'
                                        }
```

Additions are noted in red. Removed content is stricken out.

Note that the **mws.suite** parameter and the **mam.*** parameters have been moved to a suite-specific file in `/opt/mws/etc/mws.d/` and do not need to exist in `/opt/mws/etc/mws-config.groovy`.

Also note the new ***messageQueue** parameters in `/opt/mws/etc/mws-config.groovy.rpmnew`. These are required and the **moab.messageQueue.secretKey** value should match the value located in `/opt/moab/etc/moab-private.cfg`.

13. If you are using Moab Accounting Manager, do the following:

    a. If the upgrade resulted in the creation of any *.conf.rpmnew files in `/opt/mam/etc` (e.g. /opt/mam/etc/goldd.conf.rpmnew), compare your existing configuration files with those distributed with the new release to determine if you want to merge any of the new options into your configuration files.

    b. Add the new mam user as a MAM Accounting Admin.

```
[root]# su -c "gmkuser -u mam -d \"Accounting Admin\"" moab
[root]# su -c "gchrole -r SystemAdmin --add-user mam" moab
[root]# perl -p -i -e 's/moab/mam/ if /^super.user/' /opt/mam/etc/goldd.conf
```

> In this upgrade, the mam user became the new owner of MAM files and directories. If you have any custom scripts (including Moab Native scripts for MAM), these may need to be changed to be owned by the mam user.

    c. Migrate the Moab Accounting Manager database from your current version to the new version, running the migration scripts sequentially if more than one is required. For instance, to migrate your 7.2 database to 8.1, you would need to run the `migrate_7.2-7.3.pl`, `migrate_7.3-7.5.pl`, `migrate_7.5-8.0.pl`, and the `migrate_8.0-8.1.pl` scripts. The migration scripts are located in the `/usr/share/moab-hpc-accounting-manager/8.1.1/` directory.

> The migration script must be run as the user that is running the mam service.

        i. Start the mam service and determine the user running the goldd process. User "mam" is running goldd in the following example.

```
[root]# service mam start
[root]# ps -ef | grep goldd
mam      25274     1  0 Jan12 ?        00:00:01 /usr/bin/perl -w
/opt/mam/sbin/goldd
```

ii. Run the migration script as the user running the mam service.

```
[root]# su -c /usr/share/moab-hpc-accounting-manager/8.1.1/migrate_7.2-
7.3.pl mam
[root]# su -c /usr/share/moab-hpc-accounting-manager/8.1.1/migrate_7.3-
7.5.pl mam
[root]# su -c /usr/share/moab-hpc-accounting-manager/8.1.1/migrate_7.5-
8.0.pl mam
[root]# su -c /usr/share/moab-hpc-accounting-manager/8.1.1/migrate_8.0-
8.1.pl mam
```

14. Start all Adaptive services.

```
[root]# service pbs_server start
[root]# service moab start
[root]# service tomcat6 start
[root]# service pbs_mom start     # if running pbs_mom on the head node
[root]# service trqauthd start
```

Upgrading from MongoDB 2.0 to 2.4.x

Adaptive Computing recommends MongoDB version 2.4.x. Support for environments using 2.0 is now deprecated and will be removed in a future release.

1. Verify you can connect to the Mongo database.
   a. Obtain the Mongo username and password.

```
[root]# grep grails.mongo /opt/mws/etc/mws-config.groovy
grails.mongo.username = "mws_user"
grails.mongo.password = "secret3"
```

   b. Using the Mongo username and password (in our example, username is "mws_user" and pasword is "secret3"), confirm you can log in.

```
[root]# service mongod start
[root]# mongo -u mws_user -p secret3 mws
MongoDB shell version: 2.4.12
connecting to: mws
> show collections
event
mongeez
pluginInstance
...
```

2. Refer to mongodb.org (http://docs.mongodb.org/manual/release-notes/2.4-upgrade/) for instructions on how to upgrade MongoDB. Note that you must pay close attention to the information regarding instances with auth enabled (as this is the recommended setup for Moab HPC Suite).

3. Remove version 2.0 and install 2.4

```
[root]# service mongod stop
[root]# yum remove mongo20-10gen-server mongo20-10gen
[root}# yum install mongo-10gen-server
[root]# service mongod start
```

Note that the settings in the `/etc/mongod.conf` file were saved in `/etc/mongod.conf.rpmsave` while removing MongoDB 2.0. You may need to be restore any custom settings after MongoDB 2.4.x is installed in the new `/etc/mongod.conf` file (for example, "auth = true").

4. After upgrading from 2.0 to 2.4.x, you should verify that the MongoDB credentials were preserved. Refer to step 1.

Migrating the MAM Database from MySQL to PostgreSQL

PostgreSQL is now the preferred DBMS for MAM. Customers who have already installed MySQL as the DBMS for MAM are not required to migrate their database to use PostgreSQL at this time. However, MySQL is considered deprecated and new installations will only use PostgreSQL.

PostgreSQL does not provide a standard procedure for migrating an existing database from MySQL to PostgreSQL. Adaptive Computing has had success using the py-mysql2pgsql tools for migrating/converting/exporting data from MySQL to PostgreSQL. See https://github.com/philipsoutham/py-mysql2pgsq for additional details.

To Migrate the MAM Database

This procedure was successfully tested on an actual customer MySQL database with millions of transactions on CentOS 6.4. It completed in less than an hour.

1. Make a backup copy of your MySQL mam database.

```
[root]# mysqldump mam > /archive/mam.mysql
```

2. Follow the instructions to Install PostgreSQL in the *Moab HPC Suite Installation and Configuration Guide*.
   - Manual Install - Preparing for Manual Installation on page 12
   - RPM Install - Installing Moab HPC Suite RPM on page 82
3. Install the prerequisite packages.

```
[root]# yum install git postgresql-devel gcc MySQL-python python-psycopg2 PyYAML
termcolor python-devel
```

4. Install pg-mysql2pgsql (from source).

```
[root]# cd /software
[root]# git clone git://github.com/philipsoutham/py-mysql2pgsql.git
[root]# cd py-mysql2pgsql
[root]# python setup.py install
```

5. Run pg-mysql2pgsql once to create a template yaml config file.

```
[root]# py-mysql2pgsql -v
```

6. Edit the config file to specify the MySQL database connection information and a file to output the result.

```
[root]# vi mysql2pgsql.yml
```

```
mysql:
hostname: localhost
port: 3306
socket:
username: mam
password: changeme
database: mam
compress: false
destination:
# if file is given, output goes to file, else postgres
file: /archive/mam.pgsql
postgres:
hostname: localhost
port: 5432
username:
password:
database:
```

7. Run the pg-mysql2pgsql program again to convert the database.

```
[root]# py-mysql2pgsql -v
```

8. Create the mam database in PostgreSQL.

```
[root]# su - postgres
[postgres]$ psql
postgres=# create database "mam";
postgres=# create user mam with password 'changeme!';
postgres=# \q
[postgres]$ exit
```

9. Import the converted data into the PostgreSQL database.

```
[root]# su - mam
[mam]$ psql mam < /archive/mam.pgsql
```

10. Point MAM to use the new postgresql database.

```
[mam]$ cd /software/mam-latest
[mam]$ ./configure                  # This will generate an etc/goldd.conf.dist
file
[mam]$ vi /opt/mam/etc/goldd.conf   # Merge in the database.datasource from
etc/goldd.conf.dist
```

11. Restart Moab Accounting Manager.

```
[mam]$ goldd -r
```

Chapter 4 Troubleshooting

This page details some common problems and general solutions. It contains these sections:

General Issues

Moab error: "cannot determine local hostname"

```
# service moab start
Starting moab: ERROR:    cannot determine local hostname - node is misconfigured
                                    [FAILED]
```

If you encounter this error when starting Moab, check the `/opt/moab/etc/moab.cfg` file to make sure a valid host is configured. For example:

```
...
SCHEDCFG[Moab]                      SERVER=<moab-hostname>:42559
...
```

Also check `/etc/hosts` to be sure the host name resolves, at least with localhost:

```
...
127.0.0.1   <moab-hostname> localhost localhost.localdomain localhost4
localhost4.localdomain4
...
```

Moab error: "Moab will now exit due to license file not found"

```
# service moab start
Starting moab: Moab will now exit due to license file not found
Please contact Adaptive Computing (sales@adaptivecomputing.com) to get a license
for your system
                                   [FAILED]
```

If you encounter this error when starting Moab, make sure your Moab license file is named **moab.lic** and is located in the `/opt/moab/etc/` directory.

Also make sure the license is not expired. The expiration date is listed in the license file. For example:

```
# cat /opt/moab/etc/moab.lic
...
# Expires after Tue Dec 31 10:43:46 2013
...
```

Other Moab issues

Please see **Troubleshooting and System Maintenance** in the *Moab Workload Manager Administrator Guide*.

Where do I change my passwords?

MWS super user username and password

The default username and password for MWS are **moab-admin** and **changeme!** (respectively).

To change the username and/or the password for the MWS super user:

1. Stop the `tomcat6` and `moab` services.

```
[root]# service moab stop
[root]# service tomcat6 stop
```

2. Change the respective values in the following files:
   - `/opt/mws/etc/mws-config.groovy`:

```
auth.defaultUser.username = "moab-admin"
auth.defaultUser.password = "changeme!"
```

   - `/opt/moab/etc/moab-private.cfg`:

```
CLIENTCFG[RM:mws] USERNAME=moab-admin PASSWORD=changeme!
```

   - `/opt/moab/etc/cloud.cfg`:

```
CONFIG[default]      MWS_USERNAME=moab-admin
CONFIG[default]      MWS_PASSWORD=changeme!
```

3. Start the `tomcat6` service.

```
[root]# service tomcat6 start
```

4. Start the `moab` service.

```
[root]# service moab start
```

MongoDB passwords

To change the passwords for MongoDB:

1. Stop the `tomcat6` and `moab` services.

```
[root]# service moab stop
[root]# service tomcat6 stop
```

2. Change the passwords for the MongoDB accounts (i.e., **moab_user** and/or **mws_user**). For instructions, see the MongoDB documentation (http://docs.mongodb.org/manual/tutorial/change-user-password/).
3. Edit the password values in the following files:
   - `/opt/moab/etc/moab-private.cfg`:

```
MONGOUSER            moab_user
MONGOPASSWORD        secret2
```

- `/opt/mws/etc/mws-config.groovy`:

```
// MongoDB configuration.
grails.mongo.username = "mws_user"
grails.mongo.password = "secret3"
```

4. Start the `tomcat6` service.

```
[root]# service tomcat6 start
```

5. Start the `moab` service.

```
[root]# service moab start
```

Moab Web Services Issues

If something goes wrong during the MWS installation, look in the following files:

- The MWS log file. By default this is `/opt/mws/log/mws.log`.
- The Tomcat `catalina.out` file, usually in `/var/log/tomcat6 or $CATALINA_HOME/logs`.

> If you remove the `log4j` configuration from `mws-config.groovy`, MWS writes its log files to `java.io.tmpdir`. For Tomcat, `java.io.tmpdir` is generally set to `$CATALINA_BASE/temp` or `CATALINA_TMPDIR`.

This section provides information on ome common errors and their fixes.

- MongoDB: Errors during MWS startup on page 140
- MongoDB: Out of semaphores to get db connection on page 143
- MongoDB: Connection wait timeout after 120000 ms on page 143
- java.lang.OutOfMemoryError: Java heap space on page 143
- java.lang.OutOfMemoryError: PermGen space on page 143
- SEVERE: Context [/mws] startup failed due to previous errors on page 144
- Moab Reached Maximum Number of Concurrent Client Connections on page 144

If the application fails to start and gives error messages such as these:

```
Error creating bean with name 'mongoDatastore'
can't say something; nested exception is com.mongodb.MongoException
```

```
ERROR   grails.app.services.com.ace.mws.ErrorService    0
   Error encountered while attempting to authenticate account or query database;
the MongoDB server is not available. Please verify connection to server
'/127.0.0.1:27017' and that MongoDB is running.
```

MongoDB is most likely not running, or the MongoDB host and port are misconfigured.

In this case, there are a few things to verify:

- (*Not* relevant if MongoDB is installed on a separate server) **Is MongoDB installed?**

  Run the following commands to assess whether MongoDB is installed on the current server.

  ```
  $ mongo
  -bash: mongo: command not found
  ```

  To remedy, install MongoDB, start the `mongod` service and then restart the `tomcat6` service. See Preparing for Manual Installation on page 12 or Installing Moab HPC Suite RPM on page 82 for more information on how to install and configure MongoDB for Manual Installation or RPM Installation, respectively.

- (*Only* relevant if MongoDB is installed on a separate server) **Is MWS configured to connect to the remote MongoDB server?**

  Run the following commands to assess whether MongoDB is installed on the current server.

  ```
  [root]# cat /opt/mws/etc/mws-config.groovy | grep 'grails.mongo'
  // grails.mongo.username = "mws_user"
  // grails.mongo.password = "<ENTER-KEY-HERE>"
  // grails.mongo.host = "127.0.0.1"
  // grails.mongo.port = 27017
  ```

  Make sure that the `grails.mongo.*` options are configured in `/opt/mws/etc/mws-config.groovy` for the remote MongoDB server and then restart the `tomcat6` service.

  ```
  [root]# service tomcat6 restart
  ```

- **Is MWS configured to authenticate with MongoDB, and is MongoDB configured to enforce authentication?**

  Run the following commands to assess the relevant MWS and MongoDB configurations.

```
[root]# cat /opt/mws/etc/mws-config.groovy | grep 'grails.mongo'
// grails.mongo.username = "mws_user"
// grails.mongo.password = "<ENTER-KEY-HERE>"

[root]# cat /etc/mongod.conf | grep 'auth'
#noauth = true
auth = true
```

The configuration above is problematic because the `grails.mongo` credentials are commented out in the `/opt/mws/etc/mws-config.groovy` file while MongoDB is configured to enforce authentication ("auth = true"). Similar connection issues will exist if the `grails.mongo` parameters do not match the credentials configured for the "mws_user" on both the `mws` and `moab` databases in MongoDB.

(For upgrade scenarios only) If the application fails to start and gives the following message in `/opt/mws/etc/log/mws.log`:

```
java.lang.Exception: The db-migrate.js script has not yet been run. Please see the
upgrade section of the installation guide for instructions.
```

Then the `db-migrate.js` script must be run to update the schema of the `mws` database in MongoDB.

MongoDB: Out of semaphores to get db connection

To resolve this error, adjust the values of `connectionsPerHost` or `threadsAllowedToBlockForConnectionMultiplier` by adding them to `mws-config.groovy`. Example:

```
grails.mongo.options.connectionsPerHost = 60
grails.mongo.options.threadsAllowedToBlockForConnectionMultiplier = 10
```

For more information on these options, see:

- **Configuring Moab Web Services** in the *Moab Web Services Reference Guide* - Briefly discusses a few MongoDB driver options.
- MongoOptions documentation (http://api.mongodb.org/java/current/com/mongodb/MongoOptions.html) - Contains full details on all MongoDB driver options.

> You must restart Tomcat after adding, removing, or changing **grails.mongo.options** parameters.
>
> As shipped, `mws-config.groovy` does not contain any **grails.mongo.options** parameters. To adjust their values, you need to add them to `mws-config.groovy`.
>
> The default value of **connectionsPerHost** is normally 10, but MWS sets it internally to 50.
>
> The default value of **threadsAllowedToBlockForConnectionMultiplier** is 5.
>
> Any of the options listed in MongoOptions can be specified in `mws-config.groovy`. Just use the prefix **grails.mongo.options** as shown above.

MongoDB: Connection wait timeout after 120000 ms

See MongoDB: Out of semaphores to get db connection on page 143.

java.lang.OutOfMemoryError: Java heap space

Increase the size of the heap using JVM options **-Xms** and **-Xmx**. Here are the suggested values:

```
CATALINA_OPTS="-DMWS_HOME=/opt/mws -Xms256m-Xmx3g -XX:MaxPermSize=384m"
```

- -Xms: Set initial Java heap size.
- -Xmx: Set maximum Java heap size.

java.lang.OutOfMemoryError: PermGen space

Increase the size of the permanent generation using JVM option **-XX:MaxPermSize**. Here are the suggested values:

```
CATALINA_OPTS="-DMWS_HOME=/opt/mws -Xms256m -Xmx3g -XX:MaxPermSize=384m"
```

SEVERE: Context [/mws] startup failed due to previous errors

If `catalina.out` contains this error, look in `/opt/mws/log/mws.log` and `/opt/mws/log/stacktrace.log` for more details on the error.

Also ensure that the `/opt/mws/etc/mws-config.groovy` file can be read by the Tomcat user. The permissions should appear as follows:

```
$ ls -al /opt/mws/etc/mws-config.groovy
-r-------- 1 tomcat tomcat 4056 Dec  4 12:07 mws-config.groovy
```

Moab Reached Maximum Number of Concurrent Client Connections

When this error message is encountered, simply add a new line to the `moab.cfg` file:

```
CLIENTMAXCONNECTIONS 256
```

This will change the Moab configuration when Moab is restarted. Run the following command to immediately use the new setting:

```
[root]# changeparam CLIENTMAXCONNECTIONS 256
```

The number **256** above may be substituted for the desired maximum number of Moab client connections.

Chapter 5 Component Documentation

The individual components of the suite have more options and allow for more configuration than can be contained in this guide. Refer to the individual component guides for more information.

TORQUE

- TORQUE 5.1.1 Administrator Guide: HTML – PDF

Moab Workload Manager

- Moab Workload Manager 8.1.1 Administrator Guide: HTML – PDF

Moab Accounting Manager

- Moab Accounting Manager 8.1.1 Administrator Guide: HTML – PDF

Moab Web Services

- Moab Web Services 8.1.1 Reference Guide: HTML – PDF

Related Topics

Requirements on page 3
Preparing for Manual Installation on page 12
Installing Moab HPC Suite RPM on page 82