

Altair®

PBS Professional®

**2020.1**

**Licensing Guide**

You are reading the Altair PBS Professional 2020.1

## Licensing Guide (LG)

Updated 7/22/20

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## Contact Us

For the most recent information, go to the PBS Works website, [www.pbsworks.com](http://www.pbsworks.com), select "My PBS", and log in with your site ID and password.

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# About This Licensing Guide

## Document Conventions

### Abbreviation

The shortest acceptable abbreviation of a command or subcommand is underlined

### Attribute

Attributes, parameters, objects, variable names, resources, types

### Command

Commands such as `qmgr` and `scp`

### Definition

Terms being defined

### File name

File and path names

### Input

Command-line instructions

### **Method**

Method or member of a class

### Output

Output, example code, or file contents

### *Syntax*

Syntax, template, synopsis

### **Utility**

Name of utility, such as a program

### *Value*

Keywords, instances, states, values, labels

## Notation

**Optional arguments** are enclosed in square brackets. For example:

```
qstat [-E]
```

**Variables** are enclosed in angle brackets. A variable is something the user must fill in with the correct value. In the following example, the user replaces *vnnode name* with the name of the vnnode:

```
pbsnodes -v <vnnode name>
```

**Optional variables** are enclosed in angle brackets inside square brackets. For example:

```
qstat [<job ID>]
```

## About This Licensing Guide

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**Literal terms** appear exactly as they should be used. For example, to get the version of the `qstat` command, type the following exactly:

```
qstat --version
```

## PBS Professional Documentation

The PBS Professional guides and release notes apply to the *commercial* releases of PBS Professional.

### *PBS Professional Release Notes*

Supported platforms, what's new and/or unexpected in this release, deprecations and interface changes, open and closed bugs, late-breaking information. For administrators and job submitters.

### *PBS Professional Big Book*

All your favorite PBS guides in one place: Installation & Upgrade, Administrator's, Hooks, Reference, User's, and Programmer's guides in a single book.

### *PBS Professional Installation & Upgrade Guide*

How to install and upgrade PBS Professional. For the administrator.

### *PBS Professional Administrator's Guide*

How to configure and manage PBS Professional. For the PBS administrator.

### *PBS Professional Hooks Guide*

How to write and use hooks for PBS Professional. For the PBS administrator.

### *PBS Professional Reference Guide*

Covers PBS reference material.

### *PBS Professional User's Guide*

How to submit, monitor, track, delete, and manipulate jobs. For the job submitter.

### *PBS Professional Programmer's Guide*

Discusses the PBS application programming interface (API). For integrators.

### *PBS Professional Manual Pages*

PBS commands, resources, attributes, APIs.

# System Requirements and What is New

## 1.1 Supported Platforms and System Requirements

For supported platforms for PBS Professional, see the *PBS Professional Release Notes*.

For system requirements for PBS Professional, see the *PBS Professional Installation & Upgrade Guide*.

For supported platforms and system requirements for the Altair License Manager, see the *Altair License Management System*.

## 1.2 Component Version Requirements

PBS Professional 2020 requires the following:

- ALM (Altair License Management System, or ALM) version 14.5 or newer
- License feature version 20.0 or newer

## 1.3 Directory Conventions

### **PBS\_EXEC**

Execution directory for PBS Professional. Contains daemon executables.

Default:

`/opt/pbs/default`

### **PBS\_HOME**

Home directory for PBS Professional. Contains daemon configuration files, accounting logs, etc.

Default:

`/var/spool/PBS`



# License Features and Models

## 2.1 License File

In order to license your PBS Works software, you need a license file supplied by Altair Engineering, Inc. To get a license file, contact your account manager at Altair Engineering, Inc., or Altair Support by clicking “Contact Support” at [pbsworks.com](https://pbsworks.com).

The default name of the license file is `altair_lic.dat`. You can change the name of the license file.

A single Altair license server cannot host both PBSProNodes feature tokens and PBSProSockets feature tokens.

### 2.1.1 PBSProNodes Feature

We refer to these as *PBS Pro Nodes licenses* or *PBSProNodes features*. They are used by PBS Professional and Simulate (which uses just one license). Burst nodes do not use PBSProNodes licenses. Each PBSPro Nodes license stays with its node, whether or not that node has jobs running on it.

One PBSProNode licenses one physical node, subject to a four-device limit, where devices include CPU sockets, GPUs, and Xeon Phi.

### 2.1.2 PBSProSockets Feature

We refer to these as *PBS Pro Sockets licenses* or *PBSProSockets features*. They are used by PBS Professional. Each PBSPro Sockets license stays with its socket, whether or not that socket has jobs running on it.

One PBSProSocket licenses one physical socket.

## 2.2 Licensing Model for PBS Professional

When using node licenses, PBS Professional consumes PBSProNodes licenses for the nodes it reports via `pbsnodes -av`.

When using socket licenses, PBS Professional consumes PBSProSockets licenses for the sockets it reports via `pbs_topologyinfo -as`.

One PBSProNodes licenses one physical node, subject to a four-device limit, where devices include CPU sockets, GPUs, and Xeon Phi.

One PBSProSockets license covers one socket.

Nodes that are burst in the cloud consume PBSProNodes or PBSProSockets licenses.

A single Altair license server cannot host both PBSProNodes feature tokens and PBSProSockets feature tokens. However, multiple PBS complexes can share one Altair license server.



# Basic License Server Setup

This chapter covers basic installation and configuration for the Altair license server, which is called the Altair License Manager (ALM). For more details, see the *Altair License Management System* guide.

## 3.1 Introduction

The Altair License Manager (ALM) serves network licenses. It runs on a license server host that can be reached by network clients. By default, it restarts on machine restart. The Altair License Manager (ALM) is built on X-Formation's LM-X license manager suite.

### 3.1.1 Components

These are the main components of the license server used by PBS Works:

- License server (`lmx-serv` and `liblmxvendor.so/dll`)
- Configuration files (`alus.conf`, `altair-serv.cfg`, and optional command-line `.cfg` file)
- License file (`altair_lic.dat`)
- Environment variables (`ALTAIR_LICENSE_PATH`, `ALUS_CONF_FILE`, `LICENSE_SERVER_PATH`, etc.)

### 3.1.2 Ports

By default the license server uses TCP/IP port 6200. If you have another application using that port, the server will not start. You can edit the `altair-serv.cfg` file after installation to change the port used by the license server.

### 3.1.3 Running Other License Servers with ALM

You can run multiple ALM servers from different vendors on a single machine by specifying different ports.

You can run an older FLEXlm-based version of ALM (10.0 and prior) alongside the 13.0+ ALM. Be sure to specify different ports for each license server.

You can run an ALM license server side by side with the license servers of other vendors such as FLEXlm.

You can run only one license server from any specific vendor on a machine at one time.

You can run only one version of LM-X-based Altair license server on a host.

### 3.1.4 Configuration Files

The license server uses these configuration files:

**alus.conf**

Contains Altair-specific configuration information. Required. By default, located in current working directory. Location can be specified using full path in `ALUS_CONF_FILE` environment variable, or on Windows by specifying the following registry key:

```
Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Altair Engineering, Inc.\Licensing\
```

**.cfg file**

Contains generic ALM configuration data. You can specify this file on the command line. Optional.

**altair-serv.cfg**

Created by installer. Contains the location of the license file, the location in which to place the log files, which TCP/IP port to use, and other configuration information.

## 3.2 Downloading Software Package

To download the Altair License Manager, go to the Altair website via Altair Connect at <https://connect.altair.com>. Choose the package for the platform on which you will run the license server.

---

## 3.3 Running the Altair License Manager on Linux

### 3.3.1 Installing License Manager on Linux

1. Log in as root on the license server host.
2. You can run the installer via its GUI or on the command line. If you want to use the installer's GUI, provide an X server and connection. Otherwise, make sure that the environment variable DISPLAY is unset.
3. Make sure that port 6200 can be used by the license server and its clients.
4. Make sure that the installer is executable, meaning the executable bit is set.
5. Run the installer, either via the GUI or the command line:
  - Via the GUI:  
`./<package name>`
  - Via the command line:  
`./<package name> -i console`
  - a. If there is an existing license server, the installer asks whether you would like to use the license and configuration files from that installation.
  - b. Specify the location where you want to install the license server. If you provide a nonexistent directory, the installer creates it.
  - c. The installer installs the Altair License Manager.
  - d. The installer asks whether you already have a license file. If you want to use an existing file, give its location. Otherwise, the installer creates a blank `altair_lic.dat` file in the installation location; you can replace it later.
  - e. The installer displays the host ID of the machine.
  - f. The installer asks whether you want to install the init scripts for automatic startup; answer *yes* or *no*.
  - g. The installer asks about configuring the usage reporting system, and tries to contact the Altair usage reporting server. If you do not have the data to configure the proxy, you can skip this step and manually modify the `<install directory>/alus.conf` file later.

Note that the proxy password is stored in the configuration file in plain text. Be sure to limit access to this file.

### 3.3.2 Installing License File on Linux

In order to license your PBS Works software, you need a license file supplied by Altair Engineering, Inc.

1. Contact your account manager at Altair Engineering, Inc., or your local Altair support office.
2. Provide the host ID of your license server with your request. Log into the license server host and run the following command:

```
<license server install location>/bin/almutil -hostid
```

---

If you are using one of the ethernet-based host IDs, choose one that is on a permanent interface. Do not use an interface for VPNs or other software-based adapters; these may not always be present.

3. When you receive your license file, put it in the `<license server install location>` directory.
4. By default the license file is named `altair_lic.dat`. You can change the name.
5. Make sure that the value of `LICENSE_FILE` in the `altair-serv.cfg` file is the full path to the license file.
6. Restart the license server:

```
altairlmsd restart
```

## 3.4 Running the Altair License Manager on Windows

### 3.4.1 Installing License Manager on Windows

1. Make sure you have admin privilege for the account from which you will install the license server on the license server host.
2. You can run the installer via its GUI or on the command line. If you want to use the installer's GUI, provide an X server and connection. Otherwise, make sure that the environment variable `DISPLAY` is unset.
3. Make sure that port 6200 can be used by the license server and its clients.
4. Run the installer, either via the GUI or the command line:
  - Via the GUI:

```
altair_licensing_13.0.win64_x64.exe
```
  - Via the command line:

```
altair_licensing_13.0.win64_x64.exe -i console
```
  - a. If there is an existing license server, the installer asks whether you would like to use the license and configuration files from that installation.
  - b. Specify the location where you want to install the license server. If you provide a nonexistent directory, the installer creates it.
  - c. The installer installs the Altair License Manager.
  - d. The installer asks whether you already have a license file. If you want to use an existing file, give its location. Otherwise, the installer creates a blank `altair_lic.dat` file in the installation location; you can replace it later.
  - e. The installer displays the host ID of the machine.
  - f. The installer asks whether you want to have the service start up automatically; answer *yes* or *no*.
  - g. The installer asks about configuring the usage reporting system, and tries to contact the Altair usage reporting server. If you do not have the data to configure the proxy, you can skip this step and manually modify the `<install directory>\alus.conf` file later.

Note that the proxy password is stored in the configuration file in plain text. Be sure to limit access to this file.

## 3.4.2 Installing License File on Windows

In order to license your PBS Works software, you need a license file supplied by Altair Engineering, Inc.

1. Contact your account manager at Altair Engineering, Inc., or your local Altair support office.
2. Provide the host ID of your license server with your request. Log into the license server host and run the following command in a command shell:

```
C:\<Install_location>\bin\almutil -hostid
```

If you are using one of the ethernet-based host IDs, choose one that is on a permanent interface. Do not use an interface for VPNs or other software-based adapters; these may not always be present.

3. When you receive your license file, put it in the <license server install location> directory.
4. By default the license file is named `altair_lic.dat`. You can change the name.
5. Make sure that the value of `LICENSE_FILE` in the `altair-serv.cfg` file is the full path to the license file.

## 3.5 Running License Manager on MacOS

### 3.5.1 Installing License Manager on MacOS

The default installation directory is `/Applications/Altair/licensing13.0`

1. Log in as root on the license server host.
2. Make sure that port 6200 can be used by the license server and its clients.
3. Run the installer. The installer is a .zip file and needs to be unpacked.
  - a. Double-click on the zip file to unpack it
  - b. Double-click on the unpacked package
  - c. Specify the location where you want to install the license server. If you provide a nonexistent directory, the installer creates it.
  - d. The installer installs the Altair License Manager.
  - e. The installer asks whether you already have a license file. If you want to use an existing file, give its location. Otherwise, the installer creates a blank `altair_lic.dat` file in the installation location; you can replace it later.
  - f. The installer displays the host ID of the machine.
  - g. The installer asks whether you want to install the init scripts for automatic startup; answer *yes* or *no*.
  - h. The installer asks about configuring the usage reporting system, and tries to contact the Altair usage reporting server. If you do not have the data to configure the proxy, you can skip this step and manually modify the `<install_directory>/alus.conf` file later.

Note that the proxy password is stored in the configuration file in plain text. Be sure to limit access to this file.

---

## 3.5.2 Installing License File on MacOS

In order to license your PBS Works software, you need a license file supplied by Altair Engineering, Inc.

1. Contact your account manager at Altair Engineering, Inc., or your local Altair support office.
2. Provide the host ID of your license server with your request. Log into the license server host and run the following command:

```
Use almutilGUI
```

or

```
<license server install location>/bin/almutil -hostid
```

If you are using one of the ethernet-based host IDs, choose one that is on a permanent interface. Do not use an interface for VPNs or other software-based adapters; these may not always be present.

3. When you receive your license file, put it in the `<license server install location>` directory.
4. By default the license file is named `altair_lic.dat`. You can change the name.
5. Make sure that the value of `LICENSE_FILE` in the `altair-serv.cfg` file is the full path to the license file.
6. Restart the license server:

```
altairlmd restart
```

## 3.6 Updating License Manager when Changing License File

When you replace an existing license file with a new one, you must shut down the license server:

1. Log into the license server host
2. Replace the existing license file with the new one, or change the value of `LICENSE_FILE` in the `altair-serv.cfg` file to the new path.
3. Restart the license server:

```
altairlmd restart
```

This will not affect running programs. Each client will reconnect to the server once the server is restarted. This may take approximately 15 minutes.

## 3.7 Where to Find More Information

For more details about installing and configuring the ALM, and information on setting up HAL, see the *Altair License Management System* guide, available at [altair.com](http://altair.com).

# Licensing PBS Professional

## 4.1 Changes to Licensing PBS

As of version 2020.1, PBS uses node (PBSProNodes) or socket (PBSProSockets) licenses, managed by the Altair License Manager (ALM). PBS does not use any other type of license.

## 4.2 Overview of Licensing PBS Professional

A PBS complex is licensed using either node licenses or socket licenses, but not a mix. Node licenses contain PBSProNodes features, and socket licenses contain PBSProSockets features. Multiple PBS complexes can use the same Altair license server.

Each license provides licenses for a certain amount of hardware. You need enough licenses for all PBS machines in your complex. If an execution host does not have enough licenses, it cannot run jobs. You can get a node or socket license file from Altair. You will need an Altair license file when you upgrade PBS Professional or when your license expires. If you need additional licenses in the mean time, contact Altair Support.

Node and socket licensing is independent of application licensing. Applications are licensed by whichever server is required by the application.

Overview of licensing PBS:

- Install an ALM license server
- Get a node or socket license file containing PBSProNodes or PBSProSockets features, with enough licenses for your PBS complex
- Install the license file where the license server can find it
- Tell the PBS server where to find the license server

## 4.3 Licensing Glossary

### **License Manager Daemon, Altair License Manager (ALM), License Server**

Daemon that manages licenses for PBS nodes or sockets. See the *Altair License Management System Guide*, available at the Altair website, [altair.com](http://altair.com).

### **Node License**

A license that licenses a certain amount of hardware. Contains PBSProNodes features. Managed by Altair license server.

### **Redundant License Server Configuration**

Allows licenses to continue to be available should one or more license servers fail. Available configurations: three-server configuration, license server list.

### **Socket License**

A per-socket license that licenses a certain amount of hardware. Contains PBSProSockets features. Managed by Altair license server.

### Three-Server Configuration

A redundant license server configuration. One primary license server, one secondary license server, and one tertiary license server, identified by three “<port>@<host>” specifiers, in that order. Specifiers are separated by a colon. Each server on the list is tried in turn. Each server has access to the same licenses.

### License Server List

List of license servers. Each server has some of the licenses, and PBS tries each in turn. The first running server is the only server queried. The list can contain any number of license servers.

## 4.4 Configuring PBS for Licensing

To configure PBS for licensing:

1. Install, configure, and start the ALM server before you install PBS Professional.
2. Make sure the ALM license server has enough licenses for your complex.
3. Specify the license server location by setting the server’s `pbs_license_info` attribute to the location of the license server(s). The default port for the Altair license server is 6200.
  - If you are using one ALM:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<license server hostname>'
```
  - If you are using a three-server system for your ALM, put primary first, secondary second, and tertiary third:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<primary>:<port>@<secondary>:<port>@<tertiary>'
```
  - If you are using a server list system for your ALM, list servers in the order in which they should be queried:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<server1 host>[:<port>@<server2 host>:...:<port>@<serverN host>]'
```
4. Optionally, specify the minimum number of licenses to keep permanently checked out of the license server, by setting the server’s `pbs_license_min` attribute:
 

```
qmgr -c "set server pbs_license_min = <minimum number of licenses>"
```
5. Optionally, specify the maximum number of licenses to be checked out at one time, by setting the server’s `pbs_license_max` attribute:
 

```
qmgr -c "set server pbs_license_max = <maximum number of licenses>"
```
6. Optionally, specify the number of seconds to keep an unused license before returning it to the pool when there are more than the minimum number of licenses checked out, by setting the server’s `pbs_license_linger_time` attribute. Set this to a value that will prevent licenses from being checked in and out constantly. The default value is 31536000 seconds, which is one year (365 \* 24 \* 60 \* 60).
7. Verify that the PBS server reports the available licenses:
 

```
qstat -Bf | grep -e license
```
8. Verify that vnodes are licensed. Look for the `license = l (ell)` attribute setting in the output of `pbsnodes -av`:
 

```
pbsnodes -av | grep -e "^[[:alnum:]]" -e license
```

---

## 4.5 How PBS Uses Licenses

### 4.5.1 Using Socket Licenses

#### 4.5.1.1 Restrictions and Caveats for Socket Licenses

If there are not enough socket licenses to cover a host, no part of that host gets socket licenses.

### 4.5.2 Replacing Hardware

Available licenses are automatically applied to machines. If you remove or add a machine, you do not need to restart the PBS server. The new machine is automatically licensed using the available licenses.

If you delete a vnode, its licenses are released, and they are kept at the PBS complex or returned to the license server depending on the value of the `license_linger_time` PBS server attribute. Once a license is returned to the license server, it can be used at any PBS complex that is licensed by that license server.

### 4.5.3 Tracking License Use

The PBS server can keep licenses available locally. It checks the licenses out of the Altair license server. The PBS server keeps track of these licenses in the `license_count` server attribute. In this attribute, the PBS server tracks how many licenses are checked out by the PBS server in the `Avail_Local` parameter, and how many are in use in the `Used` parameter.

The minimum number of licenses to keep checked out is specified in the `pbs_license_min` server attribute.

The number of seconds to keep unused floating licenses, when the number of floating licenses is above `pbs_license_min`, is specified in `pbs_license_linger_time`.

If licenses are released, the PBS server waits `pbs_license_linger_time` seconds before checking them back into the license server, during which time they will be kept under the `Avail_Local` parameter of the `license_count` attribute.

The `Avail_Global` parameter of the `license_count` attribute tracks how many licenses are kept by the Altair license server; that is, that have not been checked out from the license server.

### 4.5.4 Manually Refreshing License Counts

If the license server becomes temporarily unavailable, PBS may not be able to license new jobs. You can force PBS to contact the license server and refresh the license counts by doing the following:

```
qmgr -c "set server pbs_license_info = <...>"
```

### 4.5.5 Licensing and PBS Server Failover

The server attribute values are saved in a shared location, and the PBS secondary server can use these licensing parameters. No additional licensing steps are needed for the PBS secondary server to work properly.

## 4.6 Displaying Licensing Information

### 4.6.1 Viewing the Number of Licenses Needed

- To see the number of node licenses you need, run the following on the server host:  
`pbs_topologyinfo -al`
- To see the number of socket licenses you need, look at the number of sockets or their equivalents. Run the following on the server host:  
`pbs_topologyinfo -as`

### 4.6.2 Viewing License Information in Server Attributes

- To see server attributes including `Flicenses`, `license_count`, `pbs_license_info`, `pbs_license_min`, etc.:  
`qstat -Bf`  
To see the number of available node or socket licenses, look at values for the `license_count` attribute.
- You can also use:  
`qmgr -c "list server"`
- If license tools such as `lmxendutil` are installed on the PBS server host, you can use them to discover the number of actual licenses available. For information about viewing licenses if `lmxendutil` is not installed on the PBS server host, see the *Altair License Management System Installation and Operations Guide*, available at the Altair website, [altair.com](http://altair.com).

#### 4.6.2.1 Example of Viewing License Info

Output of `qstat -Bf`:

```
pbs_license_info = 6200@<altair license server host>
pbs_license_min = 100
pbs_license_max = 2147483647
pbs_license_linger_time = 31536000
license_count = Avail_Global:833 Avail_Local:100 Used:0 High_Use:0
pbs_version = 2020.1.20190622093321
```

## 4.7 Licensing Attributes in the PBS Server

### 4.7.1 FLicenses

The number of floating node or socket licenses available to PBS. Equal to the `Avail_Global` + `Avail_Local` of the `license_count` attribute. Integer. Set by the server. Readable by all. Default: zero.

### 4.7.2 The `license_count` Attribute

The `license_count` server attribute has the following elements: *Avail\_Global*:<value> *Avail\_Local*:<Y> *Used*:<value> *High\_Use*:<value>

*Avail\_Global* is the number of PBS licenses still kept by the Altair License Manager (checked in).

*Avail\_Local* is the number of PBS licenses in the internal PBS license pool (checked out).

Used is the number of PBS licenses currently in use.

*High\_Use* is the highest number of licenses checked out and used at any given time while the current instance of the PBS server is running.

“*Avail\_Global*” + “*Avail\_Local*” + “*Used*” is the total number of licenses for one PBS complex.

Format: string. Set by server. Readable by all. Default: zero.

### 4.7.3 The `pbs_license_info` Attribute

Format: <port>@<host> for each license server. String. Settable by root or PBS Manager. Readable by all.

Each <host> can be an IP address.

Default value: empty string, meaning no server to contact.

Default port: 6200.

Delimiter between items is colon (“:”).

#### 4.7.3.1 Setting the `pbs_license_info` Attribute

To set this attribute, run the following as root or PBS Manager.

- If you are using one ALM:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<license server hostname>'
```
- If you are using a three-server system for your ALM, put primary first, secondary second, and tertiary third:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<primary>:<port>@<secondary>:<port>@<tertiary>'
```
- If you are using a server list system for your ALM, list servers in the order in which they should be queried:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<server1 host>[:<port>@<server2 host>:...:<port>@<serverN host>]'
```

Result:

- If the `pbs_license_info` attribute was set to a non-empty value, this sets it to the new value. All previous licenses are checked back into the previous license server, and the connection to that server is terminated.
- If `pbs_license_info` was unset, this sets it to the new value.
- Upon successful connection to the license server, PBS tries to re-license any nodes or sockets. Any jobs that are currently running continue to run, even if not all the necessary licenses are obtained.

#### 4.7.3.2 Unsetting the `pbs_license_info` Attribute

To unset `pbs_license_info`, run the following as PBS Manager or Administrator (i.e. root):

```
Qmgr: unset server pbs_license_info
```

Result:

- The `pbs_license_info` attribute is set to the empty string, previous licenses are checked back into the previous license server, and connection to this license server is shut down.
- Currently running jobs are allowed to finish.

## 4.7.4 The `pbs_license_linger_time` Attribute

The number of seconds to keep an unused license, when the number of licenses is above the value given by `pbs_license_min`. Time. Set by PBS Manager. Readable by all.

Default: 31536000 seconds (1 year)

### 4.7.4.1 Setting the `pbs_license_linger_time` Attribute

To set `pbs_license_linger_time`, run the following as a PBS manager or administrator (i.e. root):

```
Qmgr: set server pbs_license_linger_time=<value>
```

The next time PBS updates its license pool, the new value for `pbs_license_linger_time` is known internally to the PBS server.

### 4.7.4.2 Unsetting the `pbs_license_linger_time` Attribute

To unset `pbs_license_linger_time`, run the following as PBS manager or administrator (i.e. root):

```
Qmgr: unset server pbs_license_linger_time
```

Unsetting the attribute sets the value of `pbs_license_linger_time` to its default. The next time PBS updates its license pool, the value of `pbs_license_linger_time` is at the default.

## 4.7.5 The `pbs_license_max` Attribute

Maximum number of licenses to be checked out at one time, i.e maximum number of node or socket licenses to keep in the PBS local license pool. Sets a cap on the number of nodes or sockets that can be licensed at one time. Long. Set by PBS Manager. Readable by all. Default: maximum value for an integer.

### 4.7.5.1 Setting the `pbs_license_max` Attribute

To set `pbs_license_max`, run the following as a PBS manager or administrator (i.e. root):

```
Qmgr: set server pbs_license_max=<Y>
```

The next time PBS updates its license pool, the new value for `pbs_license_max` is known internally to the PBS server.

If the new value for `pbs_license_max` is less than the previous value, running jobs are allowed to finish. However, as jobs exit, the PBS server adjusts the internal license pool to have no more than the number of licenses specified in `pbs_license_max`.

### 4.7.5.2 Unsetting the `pbs_license_max` Attribute

To unset `pbs_license_max`, run the following as a PBS manager or administrator (i.e. root):

```
Qmgr: unset server pbs_license_max
```

Unsetting the attribute sets `pbs_license_max` to its default value. The next time PBS updates its license pool, the value of `pbs_license_max` is set to its default.

## 4.7.6 The `pbs_license_min` Attribute

Minimum number of licenses to permanently keep checked out of the license server, i.e. the minimum number of node or socket licenses to keep in the PBS local license pool. It is recommended that you set `pbs_license_min` to the total number of nodes or sockets in your complex. Long. Set by PBS Manager. Readable by all. If unset, PBS automatically sets the value to 0.

Default: 0.

### 4.7.6.1 Setting the `pbs_license_min` Attribute

We recommend that you set `pbs_license_min` to the total number of nodes or sockets in your complex.

To set `pbs_license_min`, run the following as a PBS manager or administrator (i.e. root):

```
Qmgr: set server pbs_license_min=<value>
```

These actions follow:

The next time PBS updates its license pool, the new value for `pbs_license_min` is known internally to the PBS server.

If the server cannot obtain the amount of licenses given by `pbs_license_min` from the license server, then it will try to obtain as many as possible, log the error, and keep trying to get more up to the correct value over some period of time.

### 4.7.6.2 Unsetting the `pbs_license_min` Attribute

To unset `pbs_license_min`, run the following as a PBS manager or administrator (i.e. root):

```
Qmgr: unset server pbs_license_min
```

This will cause `pbs_license_min` to revert to its default value.

The next time PBS updates its license pool, the value of `pbs_license_min` is at its default value, and unused licenses are returned to the license server. The return of the license(s) to the pool is constrained by `pbs_license_linger_time`.

## 4.8 Using the Altair License Manager

PBS uses an Altair License Manager for licenses. The PBS server queries the ALM for license information. The default port for the Altair license server is 6200. For more about the ALM, see [Chapter 3, "Basic License Server Setup", on page 5](#).

Each Altair License Manager can host either PBSProNodes features, or PBSProSockets features, but not both.

Multiple PBS complexes can share one instance of an Altair License Manager. In this case, the complexes must share the licenses between them. For example, if two PBS complexes share an ALM that has 100 PBSProNodes licenses, the maximum number of nodes that are licensed can be no more than 100, whether the complexes get 50 licenses each, or one complex gets all 100 licenses.

### 4.8.1 Redundant License Servers

You can use Altair license servers in a redundant license server system. If you have redundant license servers, some or all of the floating licenses used by your site will be available if a license server host crashes. You can use the PBS server/scheduler/communication host as one of the license server hosts. There are two ways to set up your license servers for redundancy:

1. The three-server configuration, where two of the three servers must be up for PBS to get licenses
2. The license server list, where PBS tries each license server in turn until it finds a working license server

In the three-server configuration, as long as at least two of the servers are up, PBS can get all the licenses. In this arrangement, each of the servers has the same license file.

In the license server list arrangement, each server has some of the licenses, and PBS will try each in turn. The first running server is the only server queried. This arrangement is better where the network is unreliable. You can have as many Altair license servers in a license server list as you want.

Set up redundancy before starting PBS.

When choosing license server hosts, choose machines that are stable and unlikely to be rebooted, and that have excellent communication.

For information on setting up redundant servers (HAL), see the *Altair License Management System* guide, available at [altair.com](http://altair.com).

### 4.8.1.1 Using Three Redundant License Servers

1. Make sure that the three servers are configured correctly according to the guidelines for the three-server arrangement.
2. Set the server's `pbs_license_info` attribute to point to the servers, in the order primary, secondary, tertiary. The delimiter is a colon (":").

```
Qmgr: set server pbs_license_info= <port>@<primary>:<port>@<secondary>:<port>@<tertiary>
```

### 4.8.1.2 Using a License Server List

1. Make sure that the servers are configured correctly according to the guidelines for the server list.
2. Set the server's `pbs_license_info` attribute to point to the list. The delimiter is a colon (":").

```
Qmgr: set server pbs_license_info=
    <port1>@<host1>:<port2>@<host2>:<port3>@<host3>:...:<portN> @<hostN>
```

## 4.8.2 Changing Licenses or License Server

- If at any time you move the license server(s) to a new port or host, set the value of `pbs_license_info` to the new location:
  - If you are using one ALM:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<license server hostname>'
```
  - If you are using a three-server system for your ALM, put primary first, secondary second, and tertiary third:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<primary>:<port>@<secondary>:<port>@<tertiary>'
```
  - If you are using a server list system for your ALM, list servers in the order in which they should be queried:
 

```
# qmgr -c 'set server pbs_license_info=<port>@<server1 host>[:<port>@<server2 host>:...:<port>@<serverN host>]'
```

- If you change the number of licenses or the license file and then restart the Altair license server, it's a good idea to refresh PBS's notion of the available licenses:

```
# qmgr -c "set server pbs_license_info = <port>@<host>"
```

then

```
# qmgr -c "set server scheduling=true"
```

- If you change to or from socket licensing, for example to change from socket licenses to node licenses, restart the PBS server:

```
systemctl restart pbs
```

---

or

```
<path to start/stop script> pbs restart
```

## 4.9 Licensing Restrictions

- Each ALM can host either PBSProNodes features, or PBSProSockets features, but not both.
- Time zone of the system must match zone of licensing features.

## 4.10 Licensing Advice

- If your license server logs are filling up with lots of small license checkouts, consider setting `pbs_license_min` to a larger number.
- Set your licensing system up so that a single failure won't cripple your entire installation. We recommend that you set up three servers either in a list or in the redundant three-server configuration. If you are using failover, we recommend that you put the license servers on the PBS primary host, the PBS secondary host, and a separate license server host.
- If you need to have `noexec` on your `/tmp`, do one of the following:
  - Set the `TMPDIR` environment variable; the shared library that is extracted to `/tmp/xf-dll` follows `TMPDIR` if it is set
  - Install a soft link from `/tmp/xf-dll` pointing to a location on a filesystem that does not have the "noexec" mount flag

Why? The ALSDK `liblms-altair.so` self-extracts a DSO into `/tmp/xf-dll`, and then tries to map it. If it fails to do so because `noexec` is set, the ALSDK routines simply perform an `exit(1)`, which terminates the server, without any log message in the server log.



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