Altair PBS Works 2021.1

Licensing Guide

You are reading the Altair PBS Works 2021.1

Licensing Guide (LG)

- Access 2020.2, 2020.3, 2020.4, 2021.1
- Control 2020.2, 2021.1
- PBS Professional 2020.1, 2021.1
- Accelerator Package 2020.01
- SAO 19.1

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Contact Us

For the most recent information, go to the PBS Works website, www.altair.com, select "My PBS", and log in with your site ID and password.

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About This Licensing Guide

What Is Covered?

In this guide, we cover licensing for Altair PBS Professional, Altair Control, and Altair Access (Web, Desktop, and Mobile versions). We give pointers to information about licensing Altair Accelerator products and SAO.

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

Document Conventions

`Abbr`eviation

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 *vnode name* with the name of the vnode:

```
pbsnodes -v <vnode name>
```

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

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

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
```

Multiple alternative choices are enclosed in curly braces. For example, if you can use either "-n" or "--name":

```
{-n | --name}
```

List of 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*, *Programmer's, Cloud, Budget,* and *Simulate* 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: the PBS commands, resource, attributes, configuration files, etc.

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.

PBS Professional Licensing Guide

How to configure licensing for PBS Professional. For the PBS administrator.

PBS Works Licensing Guide

How to configure licensing for the PBS Works suite of products. For the PBS administrator.

PBS Professional Cloud Guide

How to configure and use the PBS Professional Cloud feature.

PBS Professional Budget Guide

How to configure Budget and use it to track and manage resource usage by PBS jobs.

PBS Professional Simulate Guide

How to configure and use the PBS Professional Simulate feature.

Where to Keep the Documentation

To make cross-references work, put all of the PBS guides in the same directory.

Ordering Software and Licenses

To purchase software packages or additional software licenses, contact your Altair sales representative at pbssales@altair.com.

1 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 Control, see the *Altair Control Release Notes.*

For supported platforms and system requirements for Access Web, see the *Altair Access Web Release Notes*.

For supported platforms and system requirements for Access Desktop, see the *Altair Access Desktop Release Notes*.

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

For supported platforms and system requirements for Accelerator products, see the *Altair Accelerator Package Release Notes*.

For supported platforms and system requirements for SAO, contact Altair Sales.

1.2 Component Version Requirements

The following table shows which versions of PBS Professional, Control, and Access interoperate, and which versions of ALM, the LM-X-based license server, and license features are required for each. Access Web, Desktop, and Mobile all share the same version requirements for Control, PBS Professional, and ALM:

Table 1-1: Component Version Requirements

	Component Versions Described in this Guide		
	Access 2020.x, 2021.1 works with:	**Control 2020.2, 2021.1 works with:**	**PBS 2020.1.2, 2021.1 works with:**
Access	---	2021.1 2020.x 2019.1	2021.1 2020.4 2020.3
Control	2021.1 2020.2	---	2021.1 2020.2
PBS	2021.1 2020.1 19.2	2021.1 2020.1 19.2	---
ALM	14.5.1+	14.5.1+	14.5.1+
License Feature Version	18+	18+	20+

1.3 Directory Conventions

PAD_EXEC

Execution directory for Access Desktop. Contains binaries and scripts.

Default:

```
C:\P:rogram Files\altair\Altair Access\2018.4\exec
```

You can override the default during installation of Access Desktop.

PAD_HOME

Home directory for Access Desktop. Contains configuration and logging files.

Default:

```
C:\Users\<username>\Altair_Access\home
```

You can override the default during installation of Access Desktop.

PAW_EXEC

Execution directory for Access Web. Contains binaries and scripts.

Default:

/opt/altair/pbsworks/2018.4/exec

You can override the default during installation of Access Web.

PAW_HOME

Home directory for Access Web. Contains configuration and logging files.

Default:

/var/spool/pbsworks/2018.4/home

You can override the default during installation of Access Web.

PBS_EXEC

Execution directory for PBS Professional. Contains daemon executables.

Default:

/opt/pbs

PBS_HOME

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

Default:

/var/spool/pbs

PC_EXEC

Execution directory for Control. Contains binaries and scripts.

Default:

/opt/altair/pbsworks/2019.1/pbscontrol/exec

You can override the default during installation of Control.

PC_HOME

Home directory for Control. Contains configuration and logging files.

Default:

/var/spool/pbsworks/2019.1/pbscontrol/home

You can override the default during installation of Control.

PC_INSTALLER

Installer directory for Control. Contains installer configuration and log files.

Default:

/opt/altair/pbsworks/2019.1/pbscontrol/installer

The location of this directory is based on the location of PC_EXEC.

1.4 Terminology

ALM, Altair License Manager

The license server supplied by Altair. This license server is based on LM-X.

Altair Accelerator package

- Altair Accelerator
- Altair Accelerator Plus
- Altair FlowTracer
- Altair Monitor
- Altair Allocator
- Altair Hero

Altair PBS Works bundle

- Altair Access
- Altair Control
- Altair PBS Professional

Altair PBS Works Suite

- Altair Access
- Altair Control
- Altair PBS Professional
- Altair Accelerator
- Altair Accelerator Plus
- Altair FlowTracer
- Altair Monitor
- Altair Allocator
- Altair Hero
- Altair SAO

2 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 www.altair.com.

For all PBS Works products except for those in the Accelerator Package, the default name of the license file is `altair_lic.dat`. You can change the name of the license file. There is no default filename for the Accelerator Package license file.

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

When you use the same license file to licens Access/Control and to license PBS Professional, you install the license file in two places. One place is for the ALS, and one is for PBS Professional.

2.2 PBS Works License Features

License file feature versions must match Global Zone versions. Access and Control need Global Zones and HWU. PBS Professional does not. The following shows which parts of Access, Control, and PBS Professional use which license features:

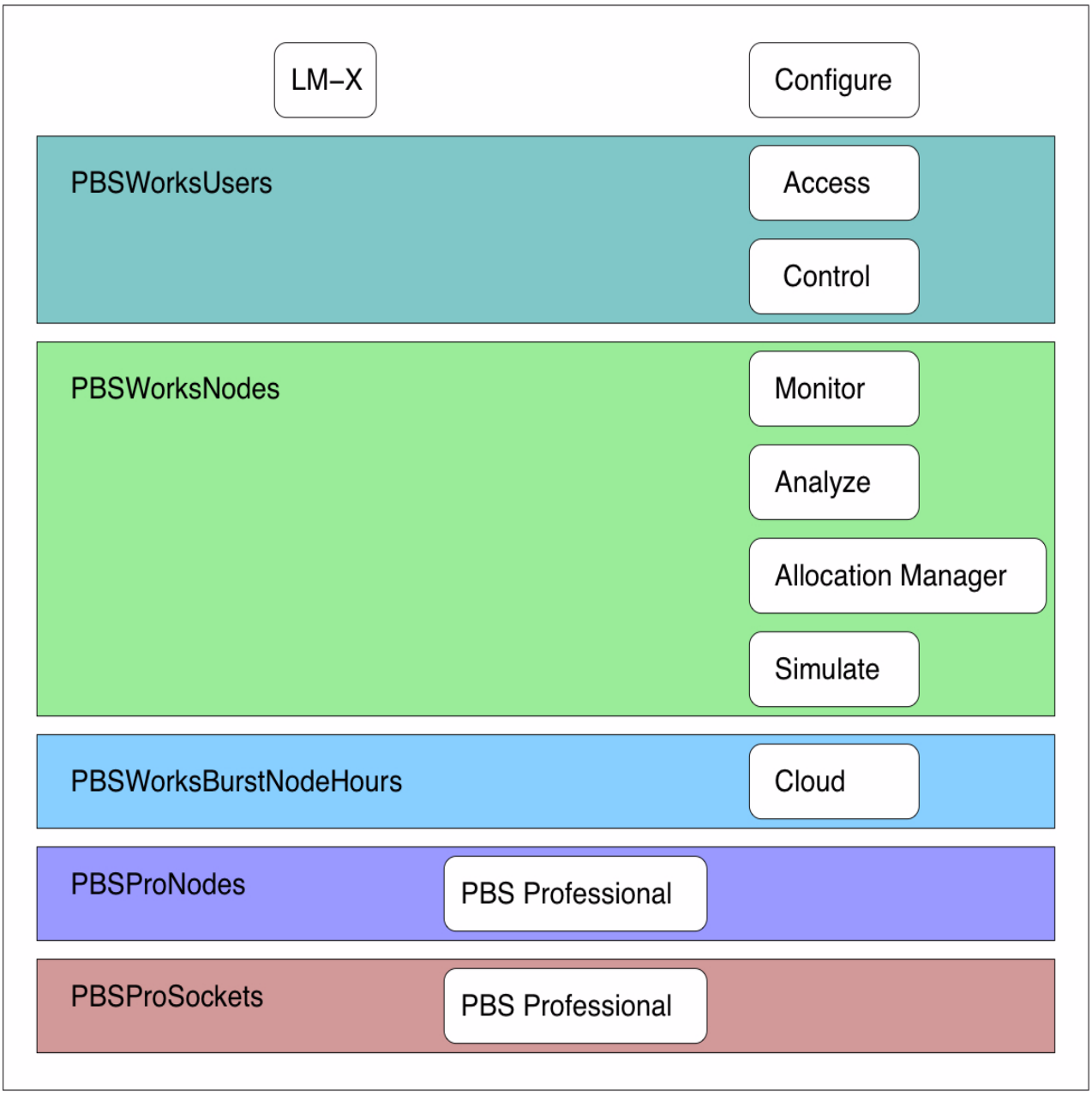

Figure 2-1:Feature use by Access, Control, and PBS Professional

2.2.1 PBSProNodes Feature

We refer to these as *PBS Pro Nodes licenses* or *PBSProNodes features*. They are used by PBS Professional, including the built-in Cloud, Budget, and Simulate features. 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 MICs, CPU sockets, GPUs, Xeon Phis, and SX-Aurora TSUBASA.

2.2.2 PBSProSockets Feature

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

One PBSProSocket licenses one physical socket, such as MIC, CPU socket, GPU, Xeon Phi, or SX-Aurora TSUBASA.

2.2.3 PBSWorksNodes

We refer to these as *PBS Works Nodes licenses* or *PBSWorksNodes features*. They are used only by Altair Control, for Monitor, Analyze, and Allocation Manager.

For Control versions 2018.x, 2019.1, one PBSWorksNode licenses one PBS Professional vnode. This is the same as the output of `pbsnodes -av`.

For Control versions 2019.x, x>=2, one PBSWorksNode is equivalent to one PBSProNode, which licenses one physical node, subject to a four-device limit, where devices include CPU sockets, GPUs, and Xeon Phis.

Login

At least 1 is required (but not consumed) for login.

Cloud

No impact; bursted nodes do not use PBSWorksNodes licenses.

Monitor

Currently active nodes count against PBSWorksNodes for monitoring purposes.

Configure

Does not use licenses.

Analyze

Currently active nodes count against PBSWorksNodes.

Cloud-bursted nodes do not count toward the total.

No node limits exist when Analyze is operating on Simulator data.

Simulate

Uses one PBSProNodes license for its internal instance of PBS Professional.

Allocation Manager

Allocation Manager requires one PBSWorksNodes license. Since this license is leveled with other PBS Works components, it effectively consumes no licenses.

PBSWorksNodes licenses level across components (Cloud, Monitor, Configure, etc), so if Monitor checks out 10 and Analyze checks out 12, the total checked out will be 12 (not 22).

2.2.4 PBSWorksUsers

We refer to these as *PBS Works User licenses* or *PBSWorksUsers features*. They are used by both Altair Access (Web, Desktop, Mobile) and Altair Control.

This is the number of simultaneously logged in users; each user who logs in checks out one PBSWorksUsers license.

PBSWorksUsers stack, not level, across products. So if 10 users are logged into Access, and 10 users are logged into Control, 20 PBSWorksUsers are checked out, even if they are the same users.

2.2.5 PBSWorksBurstNodeHours

We refer to these as *PBS Works Burst Node Hours* or *PBSWorksBurstNodeHours features*. They are used by Altair Control for Cloud. Required for cloud bursting.

These are different from all of our other licenses. PBSWorksBurstNodeHours are a declining balance, meaning they are a resource that is consumed by use, not a limit in time.

One PBSWorksBurstNodeHour gives one wall clock hour of time for a node that is burst via Control for Cloud on a Cloud provider system (Azure, AWS, etc). PBSWorksBurstNodeHours are consumed during the time it takes the node to boot. We usually burst in about 4:30 minutes, on average, across providers, which is about the time a fully-configured CentOS 7 node takes to boot. Cloud nodes have their own boot time overhead.

Granularity of measurement is one minute. Initial checkout is for 24 hours, and we refund the unused balance when a node is deprovisioned.

2.2.5.1 Recommendations for Using PBSWorksBurstNodeHours

Rules governing when to unburst are defined in the cloud bursting hook's configuration file. Consider leaving enough linger time after job completion, before deprovisioning, to allow a window for new jobs to come in. Example configuration file:

```
{
    "pclm_server": "http://<cloud_service_server>:9980/control/",
    "idle_before_unburst": 60,
    "cloud_min_instances": 1,
    "resources": ["ncpus","mem"],
    "scenario": {
        "cloud_scenario": {
            "api_key": "<api_key_for_scenario>",
            "cloud_default_image": "<Image_to_use_on_burst_nodes>",
            "instance_types": {
                "<Instance_Type>": {"ncpus": 8 , "mem": "24gb"}
            },
            "cloud_max_instances": 8,
            "max_vms_for_infiniband_scaleset" : 100,
            "max_nodes_per_burst": 50,
            "cloud_node_wait_timeout": 180
        }
    }
}
```

3 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:

1. Get an account for Altair Connect
2. Go to the Altair website via Altair Connect at https://connect.altair.com
3. 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:

   `altairlmxd 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:

   `altairlmxd 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:

   `altairlmxd 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.

3.6.1 Caveat for Changing License File

If you change the license file while there are cloud nodes, the cloud nodes can run for only another 23 hours.

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.

4 Licensing Access and Control

4.1 Overview of Licensing Access and Control

The Altair license server is called the Altair License Manager (ALM), and it serves licenses for Access and Control. When you license Control, Access is automatically licensed. You do not need to take special steps for Access.

If you change your licensing, for example by adding new kinds of licenses or more licenses, get Altair to give you a new license file.

Make sure that your license file contains all the features you need for Access and Control, including Monitor, Analyze, Allocation Manager, Simulate, and Cloud.

4.2 Enabling Licensing for Control and Access

Follow these steps when your license server is ready to serve licenses after freshly installing it. Perform the following steps as root or as a user with `sudo` permissions using the `sudo` command.

1. Install the Altair license manager, follow the instructions in Chapter 3, "Basic License Server Setup", on page 9.
2. Log into the Control headnode
3. Back up the file named `PC_HOME/config/license/environment.json`
4. Edit `environment.json` to set the value of ALTAIR_LICENSE_PATH to the location of the new license server. The license server port defaults to 6200. Format of entry:

   "ALTAIR_LICENSE_PATH":"<port>@<hostname>"

   For example:

   ```
   "ALTAIR_LICENSE_PATH":"6200@dm-10"
   ```
5. Save `environment.json`.
6. Start Control:

   ```
   pbs-control-manager start
   ```

4.2.1 Verifying Licensing Success

To verify that your license file was accepted, and that licenses are being served, check the LM-X log. You can `cat/tail` the LM-X log, and look at the features that were dumped at the bottom of the log. Look for "Ready to serve". You should see something like this:

```
[2019-04-25 15:05:28] PBSWorksNodes (v18.0) (1000 license(s)) shared on: CUSTOM VIRTUAL license
    type: exclusive expires: 2020-02-28
```

4.3 Updating Control and Access After Changing License Server or File

4.3.1 Updating Control for New License Server Path

Follow these steps when your license server is ready to serve licenses, either after freshly installing it, or moving it to a new location.

If you change the license file while there are cloud nodes, the cloud nodes can run for only another 23 hours.

Perform the following steps as root or as a user with `sudo` permissions using the `sudo` command.

1. Log into the Control headnode
2. Back up the file named `PC_HOME/config/license/environment.json`
3. Edit `environment.json` to set the value of ALTAIR_LICENSE_PATH to the location of the new license server. The license server port defaults to 6200. Format of entry:

   "ALTAIR_LICENSE_PATH":"<port>@<hostname>"

   For example:

   `"ALTAIR_LICENSE_PATH":"6200@dm-10"`
4. Save `environment.json`.
5. Start or restart Control:

   `pbs-control-manager start`

   or

   `pbs-control-manager restart`

4.3.2 Updating Simulate for New License Server Path

Simulate uses its own instance of PBS Professional, which runs on the same machine as Simulate. This is a different instance of PBS from the one managing your PBS complex. When you update Simulate, you also update Simulate's instance of PBS. Perform the following steps as root or as a user with `sudo` permissions using the `sudo` command.

1. Log into the machine hosting Simulate
2. Back up the file named `PC_HOME/pbs-control-simulator/etc/pbssim/environment`
3. Edit the file named `environment`. Update the value of ALTAIR_LICENSE_PATH to the new location of the license server. Format of entry:

<port>@<hostname>

For example:

```
ALTAIR_LICENSE_PATH=6200@localhost
```

4. Save the file named `environment`.
5. Update the licensing information used by the copy of the PBS Professional server used for Simulate (NOT the PBS server running your PBS complex):

   `qmgr -c 's s pbs_license_info=<license server port@<license server hostname>'`

6. Restart the instance of PBS Professional used for Simulate (NOT the instance running your PBS complex):

   `service pbs restart`

7. Restart Control:

   `pbs-control-manager restart`

4.3.3 Updating Analyze for New License Server Path

Perform the following steps as root or as a user with sudo permissions using the sudo command.

1. Log into the machine hosting Analyze.
2. Back up the file named `PC_EXEC/pbsa/scripts/server-start.sh`
3. Edit `server-start.sh`. Update the value of LICENSE_SERVER_PATH to the new location of the license server. The license server port defaults to 6200. Format of entry:

   JAVA_OPTS="$JAVA_OPTS -DLICENSE_SERVER_PATH=<license server port>@<license server hostname>"

   For example:

   ```
   JAVA_OPTS="$JAVA_OPTS -DLICENSE_SERVER_PATH=6200@dm-10"
   ```

4. Save `server-start.sh`
5. Restart Analyze:

   `systemctl restart pbsworks-pbsa`

4.3.4 Updating Control for New License File

After you change the license file:

1. Restart the license server
2. Restart the Control `pbswauth` daemon:

   `pbs-control-manager restart pbswauth`

When you update the license file, you do not need to do anything for Access.

4.4 Log Messages

4.4.1 Changing the Licensing Service Logging Level

Table 4-1: License Server Log Levels

Log Level	Description
OFF	Highest possible level; turns logging off
FATAL	Severe error events that may lead the application to abort
ERROR	Error events that might still allow the application to continue running
WARN	Potentially harmful situations
INFO	Informational messages that highlight the progress of the application at coarse-grained level
DEBUG	Fine-grained informational events that are most useful to debug an application
TRACE	Finer-grained informational events than DEBUG
ALL	Lowest possible level; turns on all logging

You may need to change the license server's log level when you need to troubleshoot issues.

Do the following as root or using `sudo`:

1. Log into the Control headnode.
2. Edit the file `PC_HOME/config/license/log4j.properties`.
3. Find the following line in the file:

   ```
   log4j.logger.com.altair.pbsworks.license=INFO, licenseActivityLogAppender
   ```

4. Change the value of `log4j.logger.com.altair.pbsworks.license` from "*INFO*" to the appropriate logging level.
5. Find the following line in the file:

   ```
   log4j.logger.com.altair.pbsworks.license.api=INFO, licenseApiActivityLogAppender
   ```

6. Change the value of `log4j.logger.com.altair.pbsworks.license.api` from "*INFO*" to the appropriate logging level.
7. Restart Control:

   ```
   pbs-control-manager restart
   ```

4.4.2 Location of Control Log Files

Control writes licensing log files in `PC_HOME/logs/license`.

4.5 Recommendations for Licensing Access and Control

You may want to set the user session timeout to minimize the cost of bursting cloud nodes and the number of user licenses used by inactive users. If bursting is inexpensive or rare, and your users tend to be inactive, you may want to set a short timeout. If bursting is expensive or frequent, and your users tend to be active, you may want a longer timeout. See section 10.2.3 in the *Control Administrator's Guide* for how to set the user session timeout.

Consider cloud hook configuration parameters. The maximum number of cloud licenses to renew per hook cycle is defined in max_nodes_per_burst.

4.6 Licensing Model for Control and Access

Control requires licenses that are provided by the Altair license server. Control consumes the following kinds of licenses:

- PBSWorks User (PBSWorksUsers feature)

  Consumed when users log into Control or Access.
- PBSWorks Node (PBSWorksNodes feature)

  Consumed for nodes. This happens when you add an HPC cluster via the Monitor tab, or when Analyze parses an active node because the Analytics Data Collector forwards node information derived from `pbsnodes -av`.
- PBSWorks Burst Node (PBSWorksBurstNodeHours feature)

  Consumed when Control, via Cloud, bursts a node into the cloud.
- PBSProNodes

  Consumed by Simulator (and PBS Professional).

A node in Control is a PBS Professional vnode, regardless of the number of cores or devices associated with the vnode.

4.6.1 Licensing for Logging into Control or Access

Logging into Control requires at least one PBS Works User license (a PBSWorksUsers feature) and one PBS Works Node license (a PBSWorksNodes feature).

Each user who logs into Control or Access consumes a PBS Works User license.

If a user logs into Control and then opens a second browser window for Control, the user consumes only a single PBS Works User license.

4.6.2 Licensing for Control and Access Features

The Cloud and Simulate features of Control and Access have the same names as as features in PBS Professional, but they are licensed differently.

4.6.2.1 Licensing for Configure

Configure does not consume any licenses.

4.6.2.2 Licensing for Analyze

Each active node consumes a PBSWorks Node license.

The number of PBSWorks Nodes licenses used for Analytics levels against the number of PBSWorks Nodes licenses used for Monitor.

4.6.2.3 Licensing for Monitor

Monitor consumes PBS Works Node licenses.

Each node that you manage via Control (Monitor or Analyze) requires a PBS Works Node license.

The number of PBSWorks Nodes licenses used for Analytics levels against the number of of PBSWorks Nodes licenses used for Monitor.

4.6.2.4 Licensing for Simulate

Requires one PBSProNodes license for its own instance of PBS Professional

4.6.2.5 Licensing for Cloud

Cloud requires PBS Works Burst Node Hours (PBSWorksBurstNodeHours features). When you burst nodes in the cloud, you consume Burst Node Hours. For example, if you burst 10 nodes for 8 hours, you consume 80 Burst Node Hours.

4.6.2.6 Licensing for Allocation Manager

Allocation Manager consumes one PBS Works Nodes license.

4.6.3 Restrictions and Caveats for Licensing Control

If you register clusters with more active vnodes than you have PBSWorksNodes, then you will not be able to monitor those clusters.

You cannot get job and node summary information for unlicensed nodes.

If you register clusters with more active vnodes than you have PBSWorksNodes, no Analyze data will be displayed until you either remove the extra nodes or add more licenses.

5 Licensing PBS Professional

5.1 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.

5.2 Overview of Licensing PBS Professional

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

Each license file 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.

PBS 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

5.3 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.

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.

5.4 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
   ```

5.5 How PBS Uses Licenses

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 MICs, CPU sockets, GPUs, Xeon Phis, and SX-Aurora.

One PBSProSockets license covers one socket.

Nodes that are burst in the cloud do not consume PBSProNodes licenses; they consume PBSWorksBurstNodeHours.

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.

5.5.1 Licensing for PBS Professional Features

5.5.1.1 Licensing for PBS Cloud

When you use the PBS Cloud feature to burst nodes in the cloud, those cloud nodes are licensed as if they are on-premise nodes. Make sure that you have enough licenses for the total number of on-premise and cloud nodes; you can limit the number of cloud nodes at any one time. See the *PBS Professional 2021.1 Cloud Guide*, section 3.3.6, “Managing Licenses”.

If you change the license file while there are cloud nodes, the cloud nodes can run for only another 23 hours.

5.5.1.2 Licensing for Budget

Budget checks that at least one PBSProNodes or one PBSProSockets license exists, but does not use it.

5.5.1.3 Licensing for Simulate

Simulate checks that at one PBSProNodes or one PBSProSockets license exists for each simulation being run, but does not use it.

5.5.2 Using Socket Licenses

5.5.2.1 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.

5.5.3 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.

5.5.4 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.

5.5.5 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 = <...>"
```

5.5.6 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.

5.6 Displaying Licensing Information

5.6.1 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
  ```

5.6.2 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.

5.6.2.1 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
```

5.7 Licensing Attributes in the PBS Server

5.7.1 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.

5.7.2 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.

5.7.3 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 (":").

5.7.3.1 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.

5.7.3.2 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.

5.7.4 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)

5.7.4.1 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.

5.7.4.2 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.

5.7.5 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.

5.7.5.1 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.

5.7.5.2 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.

5.7.6 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.

5.7.6.1 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.

5.7.6.2 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.

5.8 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 9.

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.

5.8.1 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.

5.8.1.1 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>
   ```

5.8.1.2 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>
```

5.8.2 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
  ```

5.9 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.

5.10 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 liblmx-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.

6 Licensing Accelerator Products and SAO

6.1 Licensing Accelerator Products

We do not describe the details of licensing Accelerator products in this guide. We list the major steps here:

1. Contact Altair Support by clicking “Contact Support” at www.altair.com.
2. Get a license file for the Accelerator Package products. This file is different from the file for other PBS Works products.
3. Go to www.altair.com and follow the link to the download area for Accelerator products.
4. Download the Altair Accelerator Package software image. This includes the license server.
5. Download the installation guide for the Accelerator Package products. The guide is titled *Altair Accelerator Package Installation Guide*, and has the filename “Altair_Accelerator_Package_Installation.pdf” or “RTDA_Installation.pdf”, depending on the release.
6. Install the license server. Follow the instructions in the *Altair Accelerator Package Installation Guide*. Licensing for Accelerator products usually requires a Reprise RLM server, although the simplest Accelerator configurations require only a license file. Ask Altair Support whether you need the RLM server.

   Contact Altair Support if you need assistance installing or configuring the RLM server.

6.1.1 Accelerator Support

For Accelerator support, you can contact Altair Support by clicking “Contact Support” at www.altair.com.

6.2 Licensing SAO

We do not describe the details of licensing SAO in this guide. We list the major steps here.

1. Contact Altair Sales. Get a license file from Altair that includes the features for SAO among the other PBS Works features.
2. Download and install the Altair License Manager according to Chapter 3, "Basic License Server Setup", on page 9 or the instructions in *Altair License Management System*.
3. Install the license file and configure the license server, following the instructions in Chapter 3, "Basic License Server Setup", on page 9 or the *Altair License Management System*.
4. On the SAO host, set the ALTAIR_LICENSE_PATH environment variable to the location of the license server:

ALTAIR_LICENSE_PATH=<license server port>@<license server hostname>

6.2.1 SAO Support

For SAO support, you can contact Altair via email.

North America: amer_saosupport@altair.com

EMEA: emea_saosupport@altair.com

APAC: apac_saosupport@altair.com

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