



# ALTAIR

ONLY FORWARD

Altair® PBS Professional® 2025.2.0

Reference Guide

You are reading the Altair PBS Professional 2025.2

## Reference Guide (RG)

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# About PBS Documentation

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

## 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**

Optional arguments are enclosed in square brackets. For example, in the `qstat` man page, the `-E` option is shown this way:

`qstat [-E]`

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To use this option, you would type:

```
qstat -E
```

### Variable Arguments

Variable arguments (where you fill in the variable with the actual value) such as a job ID or vnode name are enclosed in angle brackets. Here's an example from the `pbsnodes` man page:

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

To use this command on a vnode named "my\_vnode", you'd type:

```
pbsnodes -v my_vnode
```

### Optional Variables

Optional variables are enclosed in angle brackets inside square brackets. In this example from the `qstat` man page, the job ID is optional:

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

To query the job named "1234@my\_server", you would type this:

```
qstat 1234@my_server
```

### Literal Terms

Literal terms appear exactly as they should be used. For example, to get the version for a command, you type the command, then "--version". Here's the syntax:

```
qstat --version
```

And here's how you would use it:

```
qstat --version
```

### Multiple Alternative Choices

When there are multiple options and you should choose one, the options 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*, *Simulate*, and *GraphQL* guides in a single book.

### *PBS Professional Installation & Upgrade Guide*

How to install, upgrade, and start or stop 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*

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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*

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

### *PBS Professional Cloud Guide*

How to configure and use the PBS Professional Cloud feature in order to burst jobs to the cloud.

### *PBS Professional Budgets Guide*

How to configure Budgets 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. For the PBS Administrator and job submitter.

### *PBS Professional GraphQL Guide*

How to configure and use the PBS Professional GraphQL interface. For the PBS Administrator and job submitter.

### *PBS Professional Manual Pages*

PBS commands, resources, attributes, APIs.

### *HPCWorks Product Licensing Guide*

How to configure licensing for PBS Professional and other HPCWorks products. For the PBS administrator.

## Where to Keep the Documentation

If you're not using the *Big Book*, make cross-references work by putting all of the PBS guides in the same directory.



# Glossary of Terms

This chapter describes the terms used in PBS Professional documentation.

## Accept an action (Hooks)

A hook *accepts* an action when the hook allows the action to take place.

## Access control list, ACL

An *ACL*, or *Access Control List*, is a list of users, groups, or hosts from which users or groups may be attempting to gain access. This list defines who or what is allowed or denied access to parts of PBS such as the server, queues, or reservations. A server ACL applies to access to the server, and therefore all of PBS. A queue's ACL applies only to that particular queue. A reservation's ACL applies only to that particular reservation. See ["ACLs" on page 513 in the PBS Professional Administrator's Guide](#).

## Access to a queue

Applies to users, groups, and hosts. Being able to submit jobs to the queue, move jobs into the queue, being able to perform operations on jobs in the queue, and being able to get the status of the queue.

## Access to a reservation

Applies to users, groups, and hosts. Being able to place jobs in the reservation, whether by submitting jobs to the reservation or moving jobs into the reservation. It also means being able to delete the reservation, and being able to operate on the jobs in the reservation.

## Access to the server

Applies to users, groups, and hosts. Being able to run PBS commands to submit jobs and perform operations on them such as altering, selecting, and querying status. It also means being able to get the status of the server and queues.

## Account string

An *account string* is an arbitrary character string of characters that your site may use to provide additional accounting or charge information. The syntax is unspecified except that it must be a single string. When provided on the command line to a PBS utility or in a directive in a PBS job script, any embedded white space must be escaped by enclosing the string in quotes.

## Action (Hooks)

A PBS operation or state transition. The actions that hooks can affect are submitting a job, altering a job, running a job, making a reservation, and moving a job to another queue.

## Active (Failover)

A server daemon is active when it is managing user requests and communicating with a scheduler and MoMs.

## Active Directory (Windows)

*Active Directory* is an implementation of LDAP directory services by Microsoft to use in Windows environments. It is a directory service used to store information about the network resources (e.g. user accounts and groups) across a domain.

## Admin (Windows)

A user logged in from an account that is either:

1. A member of a group having full control over the local computer and the domain controller
2. Allowed to make domain and schema changes to the Active Directory.

**Administrator**

Same as PBS Administrator.

Linux: person with Manager privilege and root access.

Windows: person with Manager privilege who is a member of the local Administrators group.

A person who administers PBS, performing functions such as downloading, installing, upgrading, configuring, or managing PBS.

*Administrator* is distinguished from "site administrator", although often these are the same person.

**Administrators (Windows)**

A group that has built-in capabilities that give its members full control over the local system, or the domain controller host itself.

**Advance reservation**

A reservation for a specific set of resources for a specified start time and duration in the future. Advance reservations are created by users to reserve resources for jobs. The reservation is available only to the creator of the reservation and any users or groups specified by the creator.

**ALM license server**

The license server that supplies licenses to run a PBS complex. See the *PBS Works Licensing Guide*.

**AOE, Application operating environment**

The environment on a vnode. This may be one that results from provisioning that vnode, or one that is already in place

**API**

PBS provides an *Application Programming Interface*, or *API*, which is used by the commands to communicate with the server. This API is described in the *PBS Professional Programmer's Guide*. A site may make use of the API to implement new commands if so desired.

**Application checkpoint**

The application performs its own checkpointing when it receives the appropriate signal etc.

**Array job**

See "[Job array](#)".

**ASAP reservation, job-specific ASAP reservation**

Reservation created for a specific queued job, for the same resources the job requests. PBS schedules the reservation to run as soon as possible, and PBS moves the job into the reservation. Created when you use `pbs_rsub -Wqmove=<job ID>` on a queued job.

**Attribute**

An *attribute* is a data item belonging to an object such as a job, reservation, vnode, queue, hook, scheduler, or server. The attribute's value affects the behavior of or provides information about the object. See [Chapter 6, "Attributes", on page 281](#). You specify attributes via the `qmgr` command.

**Backfilling**

A scheduling policy where

1. High-priority jobs are scheduled for execution
2. Lower-priority jobs are run if the following conditions are true:
  - Resources (that cannot be used by the high-priority jobs) are available
  - The lower-priority jobs will not delay the higher-priority jobs

Lower-priority jobs selected for execution are those next in priority order that will fit in the available resources.

**Batch, Batch processing**

Allowing jobs to be run outside of the interactive login environment.

**Borrowing vnode**

The vnode where a shared vnode resource is available, but not managed.

**Built-in hook**

A hook that is supplied as part of PBS. These hooks cannot be created or deleted by administrators. See ["Managing Built-in Hooks" on page 181 in the PBS Professional Hooks Guide](#).

**Built-in resource**

A resource that is defined in PBS Professional as shipped. Examples of built-in resources are `ncpus`, which tracks the number of CPUs, and `mem`, which tracks memory. See ["Built-in vs. Custom Resources" on page 233 in the PBS Professional Administrator's Guide](#).

**Checkpoint/Restart**

Allows jobs to be checkpointed and restarted. Uses OS-provided or third-party checkpoint/restart facility.

**Checkpoint and Abort, checkpoint\_abort**

The checkpoint script or tool writes a restart file, then PBS kills and requeues the job. The job resumes from the start file when it is executed again.

**Child vnode**

On a multi-vnode machine, there is one parent vnode and one or more child vnodes. For multi-vnode machines, child vnodes represent hardware. See ["Parent vnode" on page 13](#).

**Chunk**

A set of resources allocated as a unit to a job. Specified inside a selection directive. All parts of a chunk come from the same host. In a typical MPI (Message-Passing Interface) job, there is one chunk per MPI process. See ["Chunk Resources" on page 235 in the PBS Professional Administrator's Guide](#) or ["Requesting Resources in Chunks", on page 55 of the PBS Professional User's Guide](#).

**Chunk-level resource, host-level resource**

A resource that is available at the host level, for example, CPUs or memory. Chunk resources are requested inside of a selection statement. The resources of a chunk are to be applied to the portion of the job running in that chunk.

Chunk resources are requested inside a select statement. A single chunk is requested using this form:

```
-l select=<resource name>=<value>:<resource name>=<value>
```

For example, one chunk might have 2 CPUs and 4GB of memory:

```
-l select=ncpus=2:mem=4gb
```

To request multiples of a chunk, prefix the chunk specification by the number of chunks:

```
-l select=[number of chunks]<chunk specification>
```

For example, to request six of the previous chunk:

```
-l select=6:ncpus=2:mem=4gb
```

To request different chunks, concatenate the chunks using the plus sign ("+"):

```
-l select=[number of chunks]<chunk specification>+[number of chunks]<chunk specification>
```

For example, to request two kinds of chunks, one with 2 CPUs per chunk, and one with 8 CPUs per chunk, both kinds with 4GB of memory:

```
-l select=6:ncpus=2:mem=4gb+3:ncpus=8:mem=4GB
```

**Chunk set**

An identical set of chunks requested in a select statement. The following is a chunk set: 4:ncpus=8:mem=4GB

**Cluster**

A relatively homogeneous set of systems that are used as if they are a single machine.

**Commands**

PBS supplies both command line programs that are POSIX 1003.2d conforming and a graphical interface. These are used to submit, monitor, modify, and delete jobs. These client commands can be installed on any system type supported by PBS and do not require the local presence of any of the other components of PBS.

There are three classifications of commands: user commands (which any authorized user can use), Operator commands, and Manager (or administrator) commands. Operator and Manager commands require specific access privileges.

**Communication daemon, comm**

The daemon which handles communication between the server, scheduler, and MoMs. Executable is `pbs_comm`.

**Complex**

A PBS complex consists of the machines running one primary server+scheduler (plus, optionally, a secondary backup server+scheduler) and all the machines on which the MoMs (attached to this server+scheduler) are running. A complex can be a heterogeneous mix of system architectures, and can include one or more clusters.

**Consumable resource**

A consumable resource is a resource that is reduced or taken up by being used. Examples of consumable resources are memory or CPUs. See ["Consumable vs. Non-consumable Resources" on page 233 in the PBS Professional Administrator's Guide](#).

**CPU**

Has two meanings, one from a hardware viewpoint, and one from a software viewpoint:

1. A core. The part of a processor that carries out computational tasks. Some systems present virtual cores, for example in hyperthreading.
2. Resource required to execute a program thread. PBS schedules jobs according, in part, to the number of threads, giving each thread a core on which to execute. The resource used by PBS to track CPUs is called `"ncpus"`. The number of CPUs available for use defaults to the number of cores reported by the OS. When a job requests one CPU, it is requesting one core on which to run.

**Creating a hook**

When you "create a hook" using `qmgr`, you're telling PBS that you want it to make you an empty hook object that has no characteristics other than a name.

**Custom resource**

A resource that is not defined in PBS as shipped. Custom resources are created by the PBS administrator or by PBS for some systems. See ["Built-in vs. Custom Resources" on page 233 in the PBS Professional Administrator's Guide](#).

**Data service account**

Created by PBS on installation. Account that is internal to the data service, with its own data service password. Used by PBS to log into and do operations on the data service. PBS maps this account to the PBS data service management account. Must have same name as PBS data service management account.

**Data service management account**

Created by administrator. Account with a system password. Data service account maps to the PBS data service management account and both must have the same name.



**Default server**

The default server is the server which handles any server tasks, such as client requests, unless you specify a different server. By default, PBS provides a default server; you do not need to take any action to have a default server. If you have installed more than one server, you can specify the default using these:

- The PBS\_DEFAULT environment variable
- The PBS\_SERVER parameter in /etc/pbs.conf on the local host

If both are present, PBS\_DEFAULT overrides PBS\_SERVER.

Server names have the following format:

*<hostname>[:<port number>]*

where *hostname* is the fully-qualified domain name of the host on which the server is running and *port number* is the port number to which to connect. If you do not specify *port number*, PBS defaults to using 15001.

There is always at least one active server; the default server is the active server unless another server has been made active.

**Degraded reservation**

An advance reservation for which one or more associated vnodes are unavailable.

A standing reservation for which one or more vnodes associated with any occurrence are unavailable.

**Delegation (Windows)**

A capability provided by Active Directory that allows granular assignment of privileges to a domain account or group. So for instance, instead of adding an account to the "Account Operators" group which might give too much access, delegation allows giving the account read access only to all domain users and groups information. This is done via the Delegation wizard.

**Deprecate**

We use *deprecated* to mean that something such as a feature or a platform is still supported, but will not be supported beginning with a later release. When a feature is no longer supported, we say it has been removed or is obsolete.

**Destination, destination identifier, destination queue, destination server**

String. One or more queues or a server. Jobs may be queried at or sent to a destination queue. Commands may be directed to a destination queue or server. A destination may be at the default PBS server or at another server.

Destination queue format:

*<queue name>*

Indicates specified queue at default server.

*@<server name>*

When moving a job, indicates default queue at that server.

When operating on queues, can indicate all queues at that server.

*<queue name>@<server name>*

Indicates specified queue at specified server.

Destination server format:

*(no server name)*

Indicates default server.

*@<server name>*

Indicates specified server.

*@default*

Indicates default server.

**Directive**

A means by which the user specifies to PBS the value of a job submission variable such as number of CPUs, the name of the job, etc. The default start of a directive is "*#PBS*". PBS directives either specify resource requirements or attribute values. See page ["Using PBS Directives", on page 17 of the PBS Professional User's Guide](#).

**Domain Admin Account (Windows)**

A domain account on Windows that is a member of the "Domain Admins" group.

**Domain Admins (Windows)**

A global group whose members are authorized to administer the domain. By default, the Domain Admins group is a member of the Administrators group on all computers that have joined a domain, including the domain controllers.

**Domain User Account (Windows)**

A domain account on Windows that is a member of the Domain Users group.

**Domain Users (Windows)**

A global group that, by default, includes all user accounts in a domain. When you create a user account in a domain, it is added to this group automatically.

**Endpoint**

A PBS server, scheduler, or MoM daemon.

**Enterprise Admins (Windows)**

A group that exists only in the root domain of an Active Directory forest of domains. The group is authorized to make forest-wide changes in Active Directory, such as adding child domains.

**Entity, PBS entity**

A user, group, or host.

**Entity share**

Setting job execution and/or preemption priority according to how much of the fairshare tree is assigned to each job's owner.

**Event**

A PBS operation or state transition. Also called *action*. For a list of events, see ["Event Types" on page 87 in the PBS Professional Hooks Guide](#).

**Execution event hook**

A hook that runs at an execution host. These hooks run after a job is received by MoM. Execution event hooks have names prefixed with "*execjob\_*".

**Execution host**

A computer which runs PBS jobs. An *execution host* is a system with a single operating system (OS) image, a unified virtual memory space, one or more CPUs and one or more IP addresses. Systems like Linux clusters, which contain separate computational units each with their own OS, are collections of hosts. Systems such as the HPE 8600 are also collections of hosts.

An execution host can be comprised of one or more vnodes. On the HPE 8600, each blade is treated as a vnode. See ["Vnode"](#).

**Execution queue**

A queue from which a job can be executed.

**Failover**

The PBS complex can run a backup server. If the primary server fails, the secondary takes over without an interruption in service.

**Failure action**

The action taken when a hook fails to execute. Specified in the `fail_action` hook attribute. See ["Using the fail action Hook Attribute" on page 37 in the PBS Professional Hooks Guide](#).

**Fairshare**

A scheduling policy that prioritizes jobs according to how much of a specified resource is being used by, and has recently been used by, job submitters. Job submitters can be organized into groups and subgroups, so that jobs can also be prioritized according to those groups' resource usage. Users and groups can each be allotted a percentage of total resource usage. See ["Using Fairshare" on page 141 in the PBS Professional Administrator's Guide](#).

**File staging**

*File staging* is the transfer of files between a specified storage location and the execution host. See ["Stage in"](#) and ["Stage out"](#).

**Finished jobs**

Jobs whose execution is done, for any reason:

- Jobs which finished execution successfully and exited
- Jobs terminated by PBS while running
- Jobs whose execution failed because of system or network failure
- Jobs which were deleted before they could start execution

**Floating license**

A unit of application license dynamically allocated (checked out) when a user begins using an application on some host (when the job starts), and deallocated (checked in) when a user finishes using the application (when the job ends).

**Furnishing queue/complex**

In peer scheduling, the queue/complex from which jobs are pulled to be run at another queue/complex

**Generic group limit**

A limit that applies separately to groups at the server or a queue. This is the limit for groups which have no individual limit specified. A limit for generic groups is applied to the usage across the entire group. A separate limit can be specified at the server and each queue.

**Generic project limit**

Applies separately to projects at the server or a queue. The limit for projects which have no individual limit specified. A limit for generic projects is applied to the usage across the entire project. A separate limit can be specified at the server and each queue.

**Generic user limit**

A limit that applies separately to users at the server or a queue. This is the limit for users who have no individual limit specified. A separate limit for generic users can be specified at the server and at each queue.

**Group**

A collection of system users. A user must be a member of at least one group, and can be a member of more than one group.

**Group access, Access by group**

Refers to access to PBS objects, such as the server, queues, and reservations. A user in the specified group is allowed access at the server, queues, and reservations

**Group ID (GID)**

Unique numeric identifier assigned to each group. See ["Group"](#).

**Group limit**

Refers to configurable limits on resources and jobs. This is a limit applied to the total used by a group, whether the limit is a generic group limit or an individual group limit.

**History jobs**

Jobs which will no longer execute at this server:

- Moved jobs
- Finished jobs

**Hold**

A restriction which prevents a job from being executed. When a job has a hold applied to it, it is in the *Held (H)* state. See [section 2.46, “qhold”, on page 155](#).

**Hook**

Hooks are custom executables that can be run at specific points in the execution of PBS. They accept, reject, or modify the upcoming action. This provides job filtering, patches or workarounds, and extends the capabilities of PBS, without the need to modify source code.

**Host**

A machine running an operating system. A host can be made up of one or more vnodes. All vnodes of a host share the same value for `resources_available.host`.

**Host access, Access from host**

Refers to user access at the server, queues, and reservations from the specified host

**Hostname**

A hostname is a string. A hostname is of the form <machine name>.<domain name>, where *domain name* is a hierarchical, dot-separated list of subdomains. A hostname cannot contain the following:

- A dot ("."), other than as a subdomain separator
- The commercial at sign, "@", as this is often used to separate a file from the host in a remote file name
- To prevent confusion with port numbers, a hostname cannot contain a colon (":")

**HTT**

Intel's Hyper-Threading Technology

**Idle**

A server daemon is idle when it is running, but only accepting handshake messages, not performing workload management.

**Importing a hook**

When you "import a hook" using `qmgr`, you're telling PBS which Python script to run when the hook is triggered.

**Importing a hook configuration file**

When you "import a hook configuration file" using `qmgr`, you're telling PBS which file should be stored as the configuration file for the specified hook.

**Indirect resource**

A shared vnode resource at vnode(s) where the resource is not defined, but which share the resource.

**Individual group limit**

Applies separately to groups at the server or a queue. This is the limit for a group which has its own individual limit specified. An individual group limit overrides the generic group limit, but only in the same context, for example, at a particular queue. The limit is applied to the usage across the entire group. A separate limit can be specified at the server and each queue.

**Individual project limit**

Applies separately to projects at the server or a queue. Limit for a project which has its own individual limit specified. An individual project limit overrides the generic project limit, but only in the same context, for example, at a particular queue. The limit is applied to the usage across the entire project. A separate limit can be specified at the server and each queue.

**Individual user limit**

Applies separately to users at the server or a queue. This is the limit for users who have their own individual limit specified. A limit for an individual user overrides the generic user limit, but only in the same context, for example, at a particular queue. A separate limit can be specified at the server and each queue.

**Installation account**

The account used by the administrator when installing PBS. Not the *pbsadmin* account used by PBS.

**Interactive job**

A job where standard input and output are connected to the terminal from which the job was submitted.

**Job or Batch job**

A unit of work managed by PBS. A *job* is a related set of tasks, created and submitted by the user. The user specifies the resources required by the job, and the processes that make up the job. When the user submits a job to PBS, the user is handing off these tasks to PBS to manage. PBS then schedules the job to be run, and manages the running of the job, treating the tasks as parts of a whole. A job is usually composed of a set of directives and a shell script.

**Job array**

A *job array* is a container for a collection of similar jobs submitted under a single job ID. It can be submitted, queried, modified and displayed as a unit. The jobs in the collection are called subjobs. For more on job arrays, see ["Job Arrays", on page 153 of the PBS Professional User's Guide](#).

**Job array identifier**

The identifier returned upon success when submitting a job array.

Job array identifiers are a sequence number followed by square brackets:

`<sequence number>[[[.<server name>]][@<server name>]]`

Example:

`1234[ ]`

Note that some shells require that you enclose a job array ID in double quotes.

The largest value that *sequence number* can be is set in the `max_job_sequence_id` server attribute. This attribute defaults to `9999999`. Minimum value for this attribute is `9999999`, and maximum is `999999999999`. After maximum for sequence number has been reached, job array IDs start again at `0`.

**Job array range**

A specification for a set of subjobs within a job array. When specifying a range, indices used must be valid members of the job array's indices. Format:

`<sequence number>[<first>-<last>[:<step>]][.server][@new server]`

*first* is the first index of the subjobs.

*last* is the last index of the subjobs.

*step* is the stepping factor.

**Job ID, Job identifier**

When a job is successfully submitted to PBS, PBS returns a unique identifier for the job. Format:

`<sequence number>[.<server>][@<new server>]`

The `<server>` portion indicates the name of the original server where the job was submitted.

The `@<new server>` portion indicates the current location of the job if it is not at the original server.

The largest value that *sequence number* can be is set in the `max_job_sequence_id` server attribute. This attribute defaults to 9999999. Minimum value for this attribute is 9999999, and maximum is 99999999999. After maximum for sequence number has been reached, job IDs start again at 0.

### Job name, Job array name

A job name or job array name can be at most 230 characters. It must consist only of alphabetic, numeric, plus sign ("+"), dash or minus or hyphen ("-"), underscore ("\_"), and dot or period (".") characters.

Default: if a script is used to submit the job, the job's name is the name of the script. If no script is used, the job's name is "STDIN".

### Job state

A job exists in one of the possible states throughout its existence within the PBS system. For example, a job can be queued, running, or exiting. See ["States" on page 365](#).

### Job-specific ASAP reservation, ASAP reservation

Reservation created for a specific queued job, for the same resources the job requests. PBS schedules the reservation to run as soon as possible, and PBS moves the job into the reservation. Created when you use `pbs_rsub -Wqmove=<job ID>` on a queued job.

### Job-specific now reservation, now reservation

Reservation created for a specific running job. PBS creates a job-specific now reservation on the same resources as the job is using, and moves the job into the reservation. The reservation is created and starts running immediately when you use `pbs_rsub --job <job ID>` on a running job.

### Job-specific reservation

A reservation created for a specific job, for the same resources that the job requested.

### Job-specific start reservation, start reservation

Reservation created for a specific job, for the same resources the job requests. PBS starts the job according to scheduling policy. When the job starts, PBS creates and starts the reservation, and PBS moves the job into the reservation. Created when you use `qsub -Wcreate_resv_from_job=true` to submit a job or when you `qalter` a job to set the job's `create_resv_from_job` attribute to *True*.

### Job Submission Description Language (JSDL)

Language for describing the resource requirements of jobs.

### Job-wide resource, server resource, queue resource

A job-wide resource, also called a server-level or queue-level resource, is a resource that is available to the entire job at the server or queue.

A job-wide resource is available to be consumed or matched at the server or queue if you set the server or queue `resources_available.<resource name>` attribute to the available or matching value. For example, you can define a custom resource called *FloatingLicenses* and set the server's `resources_available.FloatingLicenses` attribute to the number of available floating licenses.

Examples of job-wide resources are shared scratch space, application licenses, or walltime.

A job can request a job-wide resource for the entire job, but not for individual chunks. Job-wide resources are requested outside of a selection statement, in this form:

`-l keyword=value[,keyword=value ...]`

where *keyword* identifies either a consumable resource or a time-based resource such as **walltime**.

A resource request "outside of a selection statement" means that the resource request comes after "-l", but not after "-lselect=".

### Kill a job

To terminate the execution of a job.

### Leaf

An endpoint (a server, scheduler, or MoM daemon.)

### License Manager Daemon (**lmserv-altair**)

Daemon that functions as the license server. ALM license server. See the *PBS Works Licensing Guide*.

### License server

Manages licenses for PBS jobs. ALM license server. See the *PBS Works Licensing Guide*.

### License Server List Configuration

One form of redundant license server configuration. A collection of "<port number>@<hostname>" settings, pointing to license servers managing Altair licenses. Each server on the list is tried in turn. There could be X licenses on <server1>, Y licenses on <server2>, and Z licenses on <server3>, and the total licenses available would actually be X+Y+Z, but a request must be satisfied only by one server at a time. The first running server is the only server queried. See the *PBS Works Licensing Guide*.

### Limit

A maximum that can be applied in various situations:

- The maximum number of jobs that can be queued
- The maximum number of jobs that can be running
- The maximum number of jobs that can be queued and running
- The maximum amount of a resource that can be allocated to queued jobs
- The maximum amount of a resource that can be consumed at any time by running jobs
- The maximum amount of a resource that can be allocated to queued and running jobs

### Linux-Windows complex, Windows-Linux complex

A PBS complex with a Linux server/scheduler/comm host and Windows execution and client hosts.

### Load balance

Scheduling policy wherein jobs are distributed across multiple hosts to even out the workload on each host.

### Manager

A person who has been granted Manager privilege by being listed in the server's **managers** attribute. A Manager is authorized to use all restricted capabilities of PBS. A PBS Manager may act upon the server, queues, or jobs. See ["Manager" on page 511 in the PBS Professional Administrator's Guide](#).

### Managing vnode

The vnode where a shared vnode resource is defined, and which manages the resource.

### Master provisioning script, Master script (Hooks)

The script that makes up the provisioning hook.

### Memory-only vnode

Represents a node board that has only memory resources (no CPUs).



**Mixed-mode complex**

A PBS complex with a Linux server/scheduler/comm host, Linux execution and client hosts, and Windows execution and client hosts.

**MoM**

The daemon which runs on an execution host, managing the jobs on that host. *MoM* is the informal name for the process called `pbs_mom`. One MoM runs on each execution host.

MoM runs each job when it receives a copy of the job from the server. MoM creates a new session that is as identical to the user's login session as possible. For example under Linux, if the user's login shell is `csch`, MoM creates a session in which `.login` is run as well as `.cschrc`. MoM returns the job's output to the user when directed to do so by the server.

MoM is a reverse-engineered acronym that stands for "Machine Oriented Mini-server".

**Monitoring**

The act of tracking and reserving system resources and enforcing usage policy. This covers both user-level and system-level monitoring as well as monitoring running jobs. Tools are provided to aid human monitoring of the PBS system as well.

**Primary execution host MoM (was Mother Superior)**

The MoM on the head or first host of a multihost job. This MoM controls the job, communicates with the server, and controls and consolidates resource usage information. When a job is to run on more than one execution host, the job is sent to the MoM on the primary execution host, which then starts the job.

**Moved jobs**

Jobs which were moved to another server

No longer used. See "[Execution host](#)".

**Non-consumable resource**

A non-consumable resource is a resource that is not reduced or taken up by being used. Examples of non-consumable resources are Boolean resources and `walltime`. See "[Consumable vs. Non-consumable Resources](#)" on [page 233 in the PBS Professional Administrator's Guide](#).

**Non-job event hook**

A hook that is not directly related to a specific job. Non-job event hooks are periodic hooks, startup hooks, provisioning hooks, and reservation creation hooks.

**Now reservation, job-specific now reservation**

Reservation created for a specific running job. PBS creates a job-specific now reservation on the same resources as the job is using, and moves the job into the reservation. The reservation is created and starts running immediately when you use `pbs_rsub --job <job ID>` on a running job.

**Object, PBS object**

An element of PBS such as the server, a queue, or a reservation



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**Occurrence of a standing reservation**

An instance of the standing reservation.

An occurrence of a standing reservation behaves like an advance reservation, with the following exceptions:

- While a job can be submitted to a specific advance reservation, it can only be submitted to the standing reservation as a whole, not to a specific occurrence. You can only specify *when* the job is eligible to run. See the `qsub(1B)` man page.
- When an advance reservation ends, it and all of its jobs, running or queued, are deleted, but when an occurrence ends, only its running jobs are deleted.

Each occurrence of a standing reservation has reserved resources which satisfy the resource request, but each occurrence may have its resources drawn from a different source. A query for the resources assigned to a standing reservation will return the resources assigned to the soonest occurrence, shown in the `resv_nodes` attribute reported by `pbs_rstat`.

**Operator**

This term means a person who has been granted Operator privilege by being listed in the server's `operators` attribute. An Operator can use some but not all of the restricted capabilities of PBS. See ["Operator" on page 510 in the PBS Professional Administrator's Guide](#).

**Overall limit**

Limit on the total usage. In the context of server limits, this is the limit for usage at the PBS complex. In the context of queue limits, this is the limit for usage at the queue. An overall limit is applied to the total usage at the specified location. Separate overall limits can be specified at the server and each queue.

**Owner, Job owner**

The user who submitted a specific job to PBS.

**Parameter**

A *parameter* specifies an element of the behavior of a component of PBS. For example, MoMs have parameters specifying which events to log, or what the maximum load should be. Parameters are specified by editing the component's configuration files.

**Parent vnode**

For single-vnode machines, the only vnode is the parent vnode.

For multi-vnode machines, there is a vnode called the *parent vnode*. A parent vnode does not correspond to any actual hardware. The parent vnode is used to define any placement set information that is invariant for a given host. The parent vnode is also used to define dynamic host-level resources, and can be used to define shared resources. See ["Parent Vnodes and Child Vnodes" on page 43 in the PBS Professional Administrator's Guide](#). We used to call this vnode the "natural vnode".

For multi-vnode machines, vnodes that represent hardware are called *child vnodes*. See ["Child vnode" on page 3](#).

**Node**

A host

**pbshook**

Keyword used by `qmgr` to operate on built-in hooks.

**PBS Entity**

A user, group, or host

**pbs module**

The *pbs module* is an interface to PBS and the hook environment. The interface is made up of Python objects, which have attributes and methods. You can operate on these objects using Python code.

**PBS Object**

An element of PBS such as the server, a queue, or a reservation

**PBS Administrator**

Same as Administrator.

Linux: person with Manager privilege and root access.

Windows: person with Manager privilege who is a member of the local Administrators group.

A person who administers PBS, performing functions such as downloading, installing, upgrading, configuring, or managing PBS.

*PBS Administrator* is distinguished from "site administrator", although often these are the same person.

**pbsadmin (Windows)**

The account that is used to execute the PBS MoM, `pbs_mom`, via the Service Control Manager on Windows. This must be "*pbsadmin*".

**PBS\_HOME**

The path containing PBS files. The path under which PBS files are installed on the local system.

Default: `/var/spool/pbs`

**PBS\_EXEC**

The path containing PBS executables. The path under which PBS executables are installed on the local system.

Default: `/opt/pbs`

**PBS Professional**

A workload management system consisting of a server, a scheduler, and any number of execution hosts each managed by a MoM. PBS accepts batch jobs from users, and schedules them on execution hosts according to the policy chosen by the site. PBS manages the jobs and their output according to site-specified policy.

**Peer scheduling**

A feature allowing different PBS complexes to automatically run each others' jobs. This way jobs can be dynamically load-balanced across the complexes. Each complex involved in peer scheduling is called a *peer*.

**Placement set**

A set of vnodes on which jobs can be run, selected so that the job will run as efficiently as possible. Placement sets are used to improve task placement (optimizing to provide a "good fit") by exposing information on system configuration and topology. See ["Placement Sets" on page 170 in the PBS Professional Administrator's Guide](#).

**Placement set series**

The set of placement sets defined by a resource, where each set has the same value for the resource. If the resource takes on N values, there are N placement sets in the series. See ["Placement Sets" on page 170 in the PBS Professional Administrator's Guide](#).

**Placement pool**

All of the placement sets defined at a PBS object. Each queue can have its own placement pool, and the server can have its own placement pool. See ["Placement Sets" on page 170 in the PBS Professional Administrator's Guide](#).

**Policy, Scheduling policy**

The set of rules by which a scheduler selects jobs for execution.

**POSIX**

Refers to the various standards developed by the Technical Committee on Operating Systems and Application Environments of the IEEE Computer Society under standard P1003.

**Preempt**

Stop one or more running jobs in order to start a higher-priority job.

**Preemption level**

Job characteristic used to determine whether a job may preempt another or may be preempted, such as being in an express queue, having an owner who is over a soft limit, being a normal job, or having an owner who is over a fairshare allotment.

**Preemption method**

The method by which a job is preempted. This can be checkpointing, suspension, or requeueing.

**Preemption target**

A preemption target is a job in a specified queue or a job that has requested a specified resource. The queue and/or resource is specified in another job's `Resource_List.preempt_targets`.

**Pre-execution event hook**

A hook that runs before the job is accepted by MoM. These hooks do not run on execution hosts. Pre-execution event hooks are for job submission, moving a job, altering a job, or just before sending a job to an execution host.

**Primary scheduler**

The PBS Professional scheduler daemon which is running during normal operation.

**Primary execution host**

The execution host where a job's top task runs, and where the MoM that manages the job runs.

**Primary server**

The PBS Professional server daemon which is running during normal operation.

**Primetime and non-primetime**

An arbitrary, defined set of time slots during which scheduling follows the rules specified for primetime. By default primetime is 24/7, but you can define it to be any desired time slots. If a time slot is not primetime, it is non-primetime, during which scheduling follows non-primetime rules. There are default behaviors for primetime and non-primetime, but you can set up the behavior you want for each type. You can also define primetime and non-primetime queues. Jobs in a primetime queue run only during primetime, and jobs in non-primetime queues run only during non-primetime. See ["Using Primetime and Holidays" on page 192 in the PBS Professional Administrator's Guide](#).

**Project**

In PBS, a project is a way to group jobs independently of users and groups. A project is a tag that identifies a set of jobs. Each job's `project` attribute specifies the job's project.

**Project limit**

This is a limit applied to the total used by a project, whether the limit is a generic project limit or an individual project limit.

**Provision**

To install an OS or application, or to run a script which performs installation and/or setup

**Provisioned vnode**

A vnode which, through the process of provisioning, has an OS or application that was installed, or which has had a script run on it

**Provisioning hook**

The hook which performs the provisioning, either by calling other scripts or by running commands

**Provisioning tool**

A tool that performs the actual provisioning, e.g. HPE Performance Cluster Manager (HPCM).

**Pulling queue**

In peer scheduling, the queue into which jobs are pulled, and from which they are run

**Queue**

A *queue* is a named container for jobs at a server. There are two types of queues in PBS: routing queues and execution queues. A *routing queue* is a queue used to move jobs to other queues including those that exist on other PBS servers. A job must reside in an *execution queue* to be eligible to run and remains in an execution queue during the time it is running. In spite of the name, jobs in a queue need not be processed in queue order (first-come first-served or *FIFO*).

**Queuing**

The collecting together of work or tasks to be run on a computer. Users submit tasks or "jobs" to the resource management system where they are queued up until the system is ready to run them.

**Redundant License Server Configuration**

Allows licenses to continue to be available should one or more license servers fail. There are two types: 1) license server list configuration, and 2) three-server configuration. See the *PBS Works Licensing Guide*.

**Reject an action (Hooks)**

An action is *rejected* when a hook prevents the action from taking place.

**Requeue**

The process of stopping a running job and putting it back into the *queued* ("Q") state.

**Rerunnable**

If a running PBS job can be terminated and then restarted from the beginning without harmful side effects, the job is rerunnable. The job's **Rerunnable** attribute must be set to *y* in order for PBS to consider a job to be rerunnable.

**Reservation degradation**

PBS attempts to ensure that reservations run by finding usable vnodes when reservation vnodes become unavailable.

**Reservation ID, reservation identifier**

When a reservation is successfully submitted to PBS, PBS returns a unique identifier for the reservation.

Format for advance reservation:

*R*<sequence number>[.server][@new server]

Format for standing reservation:

*S*<sequence number>[.server][@new server]

Format for maintenance reservation:

*M*<sequence number>[.server][@new server]

**Resource**

A *resource* can be something used by a job, such as CPUs, memory, high-speed switches, scratch space, application licenses, or time, or it can be an arbitrary item defined for another purpose. PBS has built-in resources, and allows custom-defined resources. See ["Using PBS Resources" on page 229 in the PBS Professional Administrator's Guide](#).

**Restart**

A job that was stopped after being checkpointed while previously executing is executed again, starting from the point where it was checkpointed.

**Restart File**

The job-specific file that is written by the checkpoint script or tool. This file contains any information needed to restart the job from where it was when it was checkpointed.

**Restart Script**

The script that MoM runs to restart a job. This script is common to all jobs, and so must use the information in a job's restart file to restart the job.

**Route a job**

When PBS moves a job between queues. PBS provides a mechanism whereby a job is automatically moved from a routing queue to another queue. This is performed by PBS. The resource request for each job in a routing queue is examined, and the job is placed in a destination queue which matches the resource request. The destination queue can be an execution queue or another routing queue.

**Routing queue**

A queue that serves as a temporary holding place for jobs, before they are moved to another queue. Jobs cannot run from routing queues.

**Scheduler**

A scheduler is a daemon which implements some or all of the site's job scheduling policy controlling when and where each job is run. A scheduler is a process called `pbs_sched`.

**Scheduling**

The process of selecting which jobs to run when and where, according to a predetermined policy. Sites balance competing needs and goals on the system(s) to maximize efficient use of resources (both computer time and people time).

**Scheduling policy**

Scheduling policy determines when each job runs, and how much of each resource it can use. Scheduling policy consists of a system for determining the priority of each job, combined with a set of limits on how many jobs can be run, and/or how much of each resource can be used.

**Schema Admins (Windows)**

A group that exists only in the root domain of an Active Directory forest of domains. The group is authorized to make schema changes in Active Directory.

**Secondary scheduler**

The PBS Professional scheduler daemon which takes over when the primary scheduler is not available.

**Secondary server**

The PBS Professional server daemon which takes over when the primary server fails.

**Sequence number**

The numeric part of a job ID, job array ID, or reservation ID, for example, `1234`. The largest value that can be used for a sequence number is set in the [max\\_job\\_sequence\\_id](#) job attribute.

**Server**

The central PBS daemon, which does the following:

- Handles PBS commands
- Receives and creates batch jobs
- Sends jobs for execution

The server is the process called `pbs_server`.

Each PBS complex has one primary server, and if the complex is configured for failover, a secondary server.

The server contains a licensing client which communicates with the licensing server for licensing PBS jobs.

PBS provides a default server; see ["Default server" on page 5](#).

**Server name**

A server name is an ASCII character string. Format:

`<hostname>[:<port number>]`

The network routine `gethostbyname` is used to translate this to a network address. The network routine `getservbyname` is used to determine the port number. An alternate port number may be specified by appending a colon (":") and the port number to the hostname.

**Shared resource**

A vnode resource defined and managed at one vnode, but available for use at others.

**Shrink-to-fit job**

A job that requests the `min_walltime` resource. A shrink-to-fit job requests a running time in a specified range, where `min_walltime` is required, and `max_walltime` is not. PBS computes the actual `walltime`.

**Sister**

Any MoM that is not on the head or first host of a multihost job. A sister is directed by the primary execution host. Also called a *subordinate MoM*.

**Sisterhood**

All of the MoMs involved in running a particular job.

**Site**

A location which for our purposes uses (or will use) PBS. A site can employ one or more PBS complexes, each made up of any combination of hardware and software that PBS supports.

**Snapshot Checkpoint**

The checkpoint script or tool writes a restart file, and the job continues to execute. The job resumes from this start file if the system experiences a problem during the job's subsequent execution.

**Soonest occurrence of a standing reservation**

The occurrence which is currently active, or if none is active, it is the next occurrence.

**Stage in**

The process of moving one or more job-related files from a storage location to the execution host before running the job.

**Stage out**

The process of moving one or more job-related files from the execution host to a storage location after running the job.

## Staging and execution directory

The *staging and execution directory* is a directory on the execution host where the following happens:

- Files are staged into this directory before execution
- The job runs in this directory
- Files are staged out from this directory after execution

A job-specific staging and execution directory can be created for each job, or PBS can use a specified directory, or a default directory. See ["Staging and Execution Directories for Job" on page 493 in the PBS Professional Administrator's Guide](#).

## Standing reservation

An advance reservation which recurs at specified times. For example, the user can reserve 8 CPUs and 10GB every Wednesday and Thursday from 5pm to 8pm, for the next three months.

## Start reservation, Job-specific start reservation

Reservation created for a specific queued job, for the same resources the job requests. PBS starts the job according to scheduling policy. When the job starts, PBS creates and starts the reservation, and PBS moves the job into the reservation. Created when you use `qsub -Wcreate_resv_from_job=true` on a queued job.

## State

The PBS server, vnodes, reservations, and jobs can be in various states, depending on what PBS is doing. For example the server can be *idle* or *scheduling*, vnodes can be *busy* or *free*, and jobs can be *queued* or *running*, among other states. For a complete description of states, see ["States" on page 365](#).

## Strict ordering

A scheduling policy where jobs are run according to policy order. If the site-specified policy dictates a particular priority ordering for jobs, that is the order in which they are run. Strict ordering can be modified by backfilling in order to increase throughput. See ["Backfilling"](#).

## Subject

A process belonging to a job run by an authorized, unprivileged user (a job submitter.)

## Subjob

One of the jobs in a job array, e.g. 1234 [ 7 ], where 1234 [ ] is the job array itself, and 7 is the index. Queued subjobs are not individually listed in the queue; only their job array is listed. Running subjobs are individually listed.

## Subjob index

The unique index which differentiates one subjob from another. This must be a non-negative integer.

## Subordinate MoM

Any MoM that is not on the head or first host of a multihost job. A subordinate MoM is directed by the primary execution host. Also called a *sister*.

## Task

A process belonging to a job. A POSIX session started by MoM on behalf of a job.

## Task placement

The process of choosing a set of vnodes to allocate to a job that will both satisfy the job's resource request (select and place specifications) and satisfy the configured scheduling policy.

## Three-server configuration

One form of redundant license server configuration. Means that if any 2 of the 3 license servers are up and running (referred to as a quorum), the system is functional, with 1 server acting as master who can issue licenses. If the master goes down, another server must take over as master. See the *PBS Works Licensing Guide*.



**TPP**

TCP-based Packet Protocol. Protocol used by `pbs_comm`.

**User**

Has two meanings:

1. A person who submits jobs to PBS, as differentiated from Operators, Managers and administrators. See ["User" on page 510 in the PBS Professional Administrator's Guide](#).
2. A system user, identified by a unique character string (the user name) and by a unique number (the user ID). Any person using the system has a username and user ID.

**User access, Access by user**

The specified user is allowed access at the server, queues, and reservations .

**User ID, UID**

A unique numeric identifier assigned to each user.

**User limit**

Refers to configurable limits on resources and jobs. A limit placed on one or more users, whether generic or individual.

**Vchunk**

The part of a chunk that is supplied by one vnode. If a chunk is broken up across multiple vnodes, each vnode supplies a vchunk.

**Version 1 configuration file**

MoM configuration file containing MoM configuration parameters. See [Chapter 3, "MoM Parameters", on page 247](#).

**Version 2 configuration file**

Also called `vnodedefs` file. Vnode configuration file containing vnode attribute and resource settings. Created using `pbs_mom -s insert` command. See ["Version 2 Vnode Configuration Files" on page 48 in the PBS Professional Administrator's Guide](#).

**Virtual processor, VP**

PBS can treat a vnode as if it has more processors available than the number of physical processors. When `resources_available.ncpus` is set to a number higher than the actual number of physical processors, the vnode can be said to have virtual processors. Also called logical processors.

**Vnode**

A virtual node, or *vnode*, is an abstract object representing a host or a set of resources which form a usable part of an execution host. This could be an entire host, or a nodeboard or a blade. A single host can be made up of multiple vnodes. Each vnode can be managed and scheduled independently. Each vnode in a complex must have a unique name. Vnodes on a host can share resources, such as node-locked licenses.

**vnodedefs file**

A Version 2 configuration file. Vnode configuration file containing vnode attribute and resource settings. Created using `pbs_mom -s insert` command. See ["Version 2 Vnode Configuration Files" on page 48 in the PBS Professional Administrator's Guide](#).

**vp**

Virtual processor. The smallest unit of execution resources that can be specified to run a job.

**Windows-Linux complex, Linux-Windows complex**

A PBS complex with a Linux server/scheduler/comm host and Windows execution and client hosts.



# 2

# PBS Commands

The commands described in this chapter work with a live PBS Professional complex; you cannot use these implementations on a simulation. The Simulate feature uses commands that are implemented for use with simulations; for those, see [Chapter 4, "Simulate Command Reference", on page 25](#) of the *PBS Professional Simulate Guide*.

## 2.1 Our Command Notation

### Notation

#### **Optional Arguments**

Optional arguments are enclosed in square brackets. For example, in the `qstat` man page, the `-E` option is shown this way:

```
qstat [-E]
```

To use this option, you would type:

```
qstat -E
```

#### **Variable Arguments**

Variable arguments (where you fill in the variable with the actual value) such as a job ID or vnode name are enclosed in angle brackets. Here's an example from the `pbsnodes` man page:

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

To use this command on a vnode named "my\_vnode", you'd type:

```
pbsnodes -v my_vnode
```

#### **Optional Variables**

Optional variables are enclosed in angle brackets inside square brackets. In this example from the `qstat` man page, the job ID is optional:

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

To query the job named "1234@my\_server", you would type this:

```
qstat 1234@my_server
```

#### **Literal Terms**

Literal terms appear exactly as they should be used. For example, to get the version for a command, you type the command, then `--version`. Here's the syntax:

```
qstat --version
```

And here's how you would use it:

```
qstat --version
```

**Multiple Alternative Choices**

When there are multiple options and you should choose one, the options are enclosed in curly braces. For example, if you can use either "-n" or "--name":

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

## 2.2 List of Commands

### 2.2.1 Requirements for Commands

Some PBS commands require root privilege or PBS Operator or Manager privilege in order to run. Some can be executed by anyone, but the output depends upon the privilege of the user.

Most PBS commands require that the server be running; some require that MoMs be running.

The following table lists the commands, and indicates the permissions required to use each, and whether the server or MoM must be running.

**Table 2-1: PBS Commands**

| Command                       | Action   | Permission Required             | Server Must Be Running? | MoM Must Be Running? |
|-------------------------------|--|---------------------------------|-------------------------|----------------------|
| <a href="#">hpcgentoken</a>   | Generates user authentication tokens   | Any                             | Yes                     | No                   |
| <a href="#">mpiexec</a>       | Runs MPI programs under PBS on Linux   | Any                             | No                      | No                   |
| <a href="#">pbs</a>           | Start, stop, restart, or get the PIDs of PBS daemons   | Root on Linux; Admin on Windows | No                      | No                   |
| <a href="#">pbsdsh</a>        | Distributes tasks to vnodes under PBS  | Root on Linux; Admin on Windows | No                      | Yes                  |
| <a href="#">pbsfs</a>         | Show or manipulate PBS fair-share usage data   | Any                             | Yes                     | No                   |
| <a href="#">pbsnodes</a>      | Query PBS host or vnode status, mark hosts free or offline, change the comment for a host, or output vnode information | Result depends on permission    | Yes                     | No                   |
| <a href="#">pbsrun</a>        | General-purpose wrapper script for mpirun  | Root or PBS administrator only  | No                      | No                   |
| <a href="#">pbsrun_unwrap</a> | Unwraps mpirun, reversing pbsrun_wrap  | Root on Linux                   | No                      | No                   |
| <a href="#">pbsrun_wrap</a>   | General-purpose script for wrapping mpirun in pbsrun   | Root on Linux                   | No                      | No                   |
| <a href="#">pbs_account</a>   | For Windows. Manage PBS service account  | Admin on Windows                | No                      | No                   |

Table 2-1: PBS Commands

| Command                         | Action  | Permission Required             | Server Must Be Running?                                | MoM Must Be Running? |
|---------------------------------|---|---------------------------------|--|----------------------|
| <a href="#">pbs_attach</a>      | Attaches a session ID to a PBS job  | Root, Admin, or job owner       | Yes  | Yes                  |
| <a href="#">pbs_comm</a>        | Starts the PBS communication daemon   | Root on Linux                   | No   | No                   |
| <a href="#">pbs_datSERVICE</a>  | Start, stop, or check the status of PBS data service                                  | Root on Linux                   | No   | No                   |
| <a href="#">pbs_ds_password</a> | Sets or changes data service user account or its password                             | Root on Linux; Admin on Windows | No   | No                   |
| <a href="#">pbs_hostn</a>       | Reports hostname and network address(es)  | Any                             | No   | No                   |
| <a href="#">pbs_idled</a>       | Runs PBS daemon that monitors the console and informs pbs_mom of idle time            | Root or PBS administrator only  | No   | No                   |
| <a href="#">pbs_iff</a>         | Tests authentication with the server  | Any; useful only to root        | Yes  | No                   |
| <a href="#">pbs_interactive</a> | For Windows. Register, unregister, or get the version of PBS_INTERACTIVE service      | Administrator only              | No   | No                   |
| <a href="#">pbs_login</a>       | Caches encrypted user password for authentication                                     | Any                             | No, for PBS service account<br>Yes, for job submitters | No                   |
| <a href="#">pbs_mkdirs</a>      | For Windows. Create, or fix the permissions of, the directories and files used by PBS | PBS administrator only          | No   | No                   |
| <a href="#">pbs_mom</a>         | Runs the PBS job monitoring and execution daemon                                      | Root on Linux; Admin on Windows | No   | No                   |
| <a href="#">pbs_mpihp</a>       | Runs an MPI application in a PBS job with HP MPI                                      | Any                             | Yes  | Yes                  |
| <a href="#">pbs_mpirun</a>      | Runs MPI programs under PBS with MPICH  | Any                             | Yes  | Yes                  |
| <a href="#">pbs_probe</a>       | <b>Deprecated.</b> Reports PBS diagnostic information and fixes permission errors     | Root or PBS administrator only  | No   | No                   |
| <a href="#">pbs_python</a>      | Python interpreter for debugging a hook script from the command line                  | Any                             | No   | No                   |

Table 2-1: PBS Commands

| Command                           | Action   | Permission Required  | Server Must Be Running? | MoM Must Be Running? |
|-----------------------------------|--|--|-------------------------|----------------------|
| <a href="#">pbs_ralter</a>        | Modifies an existing advance, standing, or job-specific reservation            | Job owner or PBS administrator   | Yes                     | No                   |
| <a href="#">pbs_rdel</a>          | Deletes a PBS advance, standing, or job-specific reservation                   | Any  | Yes                     | No                   |
| <a href="#">pbs_release_nodes</a> | Releases sister hosts or vnodes assigned to a PBS job                          | Job owner, PBS Manager, Operator, administrator, root on Linux, Admin on Windows | Yes                     | Yes                  |
| <a href="#">pbs_rstat</a>         | Shows status of PBS advance, standing, or job-specific reservations            | Any  | Yes                     | No                   |
| <a href="#">pbs_rsub</a>          | Creates a PBS advance, standing, or job-specific reservation                   | Any  | Yes                     | No                   |
| <a href="#">pbs_sched</a>         | Runs a PBS scheduler   | Root on Linux  | No                      | No                   |
| <a href="#">pbs_server</a>        | Starts a PBS batch server  | Root on Linux  | No                      | No                   |
| <a href="#">pbs_snapshot</a>      | Linux only. Captures PBS workload and configuration data                       | Root on Linux  | Yes                     | No                   |
| <a href="#">pbs_tclsh</a>         | <b>Deprecated.</b> TCL shell with TCL-wrapped PBS API                          | Any  | No                      | No                   |
| <a href="#">pbs_tmrsh</a>         | TM-enabled replacement for <code>rsh/ssh</code> for use by MPI implementations | Any  | No                      | Yes                  |
| <a href="#">pbs_topologyinfo</a>  | Reports topological information  | Root or Windows administrator only   | No                      | No                   |
| <a href="#">pbs_update_certs</a>  | Updates TLS certificates   | Root   | No                      | No                   |
| <a href="#">pbs_wish</a>          | <b>Deprecated.</b> TK window shell with TCL-wrapped PBS API                    | Any  | No                      | No                   |
| <a href="#">printjob</a>          | Prints job information   | Root or Windows Administrator only   | No                      | No                   |
| <a href="#">qalter</a>            | Alters a PBS job   | Any  | Yes                     | No                   |
| <a href="#">qdel</a>              | Deletes PBS jobs   | Any  | Yes                     | No                   |
| <a href="#">qdisable</a>          | Prevents a queue from accepting jobs   | Manager or Operator only   | Yes                     | No                   |
| <a href="#">qenable</a>           | Allows a queue to accept jobs  | Manager or Operator only   | Yes                     | No                   |

Table 2-1: PBS Commands

| Command                | Action  | Permission Required   | Server Must Be Running? | MoM Must Be Running? |
|------------------------|---|---|-------------------------|----------------------|
| <a href="#">qhold</a>  | Holds PBS batch jobs  | Some holds can be set by Operator, Manager, root, or administrator only   | Yes                     | No                   |
| <a href="#">qmgr</a>   | Administrator's command interface for managing PBS                      | Any   | Yes                     | No                   |
| <a href="#">qmove</a>  | Moves a PBS job from one queue to another                               | Any; managers and operators can move jobs in some cases where unprivileged users cannot   | Yes                     | No                   |
| <a href="#">qmsg</a>   | Writes message string into one or more job output files                 | Any   | Yes                     | No                   |
| <a href="#">qorder</a> | Swaps queue positions of two PBS jobs                                   | Any   | Yes                     | No                   |
| <a href="#">qrerun</a> | Requeues a PBS job  | Manager or Operator only  | Yes                     | No                   |
| <a href="#">qrls</a>   | Releases holds on PBS jobs  | Some holds can be released by Operator, Manager, root, or administrator only  | Yes                     | No                   |
| <a href="#">qrun</a>   | Runs a PBS job immediately  | Operator or Manager only  | Yes                     | No                   |
| <a href="#">qsig</a>   | Selects specified PBS jobs  | Any   | Yes                     | No                   |
| <a href="#">qsig</a>   | Send signal to PBS job  | Operator or Manager required to send <i>admin-suspend</i> , <i>admin-resume</i> , <i>suspend</i> , and <i>resume</i> . Any privilege for other signals. | Yes                     | Yes                  |
| <a href="#">qstart</a> | Turns on scheduling or routing for the jobs in a PBS queue              | Operator or Manager only  | Yes                     | No                   |
| <a href="#">qstat</a>  | Displays status of PBS jobs, queues, or servers                         | Result depends on permission  | Yes                     | No                   |
| <a href="#">qstop</a>  | Prevents PBS jobs in the specified queue from being scheduled or routed | Operator or Manager only  | Yes                     | No                   |
| <a href="#">qsub</a>   | Submits a job to PBS  | Any   | Yes                     | No                   |

Table 2-1: PBS Commands

| Command                            | Action  | Permission Required            | Server Must Be Running? | MoM Must Be Running? |
|------------------------------------|---|--------------------------------|-------------------------|----------------------|
| <a href="#">qterm</a>              | Terminates one or both PBS servers, and optionally terminates scheduler and/or MoMs | Operator or Manager only       | Yes                     | No                   |
| <a href="#">tracejob</a>           | Extracts and prints log messages for a PBS job                                      | Root or PBS administrator only | No                      | No                   |
| <a href="#">win_postinstall.py</a> | For Windows. Configures PBS services  | Administrator                  | No                      | No                   |

## 2.2.2 Windows Requirements

Under Windows, use double quotes when specifying arguments to PBS commands.

## 2.3 hpcgentoken

Generates user authentication tokens

### 2.3.1 Synopsis

```
hpcgentoken -u <user ID> [-e <lifetime>] [-h] -k <absolute path to TLS key pair> [-V] [-version]
```

```
hpcgentoken [-e <lifetime>] [-h] -k <absolute path to TLS key pair> [-V] [-version]
```

### 2.3.2 Description

You can use the `hpcgentoken` tool to create web API user tokens.

The `hpcgentoken` command is designed to be used either in restricted-access mode, where only the administrator has permissions to run it and generate tokens, or in user mode, where web API users can run the command to generate their own tokens. By default, `hpcgentoken` runs in restricted-access mode, where only the administrator can generate tokens.

We recommend that administrators, rather than API users, create any JWT tokens. The administrator can then provide the tokens to the users. If the administrator creates the tokens, the administrator can track which users have which tokens, which makes management of compromised tokens much easier.

Tokens generated via `hpcgentoken` have a default lifetime of 10 days; you can set a different lifetime when you create a token.

#### 2.3.2.1 Prerequisites for Using hpcgentoken

The `hpcgentoken` tool uses authentication certificates that reside on the PBS server host in `PBS_HOME/certs`. If you will use the `hpcgentoken` tool and you do not have certificates already, create them using `pbs_update_certs -r`.

When validating GraphQL requests via JWT, PBS checks whether `hpcgentoken` is in the list of accepted authorization issuers. To allow JWT-based validation of GraphQL requests, `hpcgentoken` must be listed in the `webapi_auth_issuers` server attribute. (To disable JWT-based authentication, remove `hpcgentoken` from the `webapi_auth_issuers` server attribute.)

#### 2.3.2.2 Restricted-access Mode for hpcgentoken

When the administrator runs `hpcgentoken` in restricted-access mode:

- Only the administrator can run the command
- The administrator uses the `-u` option to specify the username for whom the token is to be generated
- The administrator generates all tokens on behalf of users
- The `setuid` bit is not required on the `hpcgentoken` binary
- The permissions for the `hpcgentoken` binary are `0700` (the default)

### 2.3.2.3 Web API User Mode for hpcgentoken

When non-root web API users run `hpcgentoken` to generate their own tokens:

- Each web API user generates their own token(s)
- The person running `hpcgentoken` does not use the `-u` option
- The `setuid` bit is required on the `hpcgentoken` binary, to allow it access to the `PBS_HOME/certs/key.pem` file generated by the administrator
- The permissions for the `hpcgentoken` binary need to be `4755`

By default, `hpcgentoken` runs in restricted-access mode and has permissions of `0700`.

If you want web API users to be able to run `hpcgentoken`:

- Set the permissions for `hpcgentoken` to `4755`
- Make sure that the `hpcgentoken` binary has the SUID bit set. As root:

```
chmod u+s $PBS_EXEC/bin/hpcgentoken
```

This allows the `hpcgentoken` tool to read the `PBS_HOME/certs/key.pem` file generated by the administrator.

### 2.3.3 Options

**-e <seconds>**

Sets token lifetime. Default lifetime is 10 days (864,000 seconds).

Optional.

**-h, -help, --help**

Shows a help menu. Optional.

**-k**

Absolute path to the TLS key pair to be used to sign the token. Required.

**-u**

Used with the default restricted-access mode, where only the administrator can run `hpcgentoken`. Specifies user on whose behalf the administrator is generating a token.

When used in this mode, the `hpcgentoken` tool verifies that the invoking user is actually root, and that the username specified via the `-u` option actually exists on the host where `hpcgentoken` is invoked.

**-V**

Prints username along with token in the format `<username>:<token>`

Optional.



## 2.4 mpiexec

Runs MPI programs under PBS on Linux

### 2.4.1 Synopsis

*mpiexec*

*mpiexec --version*

### 2.4.2 Description

The PBS `mpiexec` command provides the standard `mpiexec` interface on a system running supported versions of HPE MPI. If executed on a different system, it will assume it was invoked by mistake. In this case it will use the value of `PBS_O_PATH` to search for the correct `mpiexec`. If one is found, the PBS `mpiexec` will exec it.

The PBS `mpiexec` calls the HPE `mpirun(1)`.

It is transparent to the user; MPI jobs submitted outside of PBS run as they would normally. MPI jobs can be launched across multiple HPE systems. PBS will manage, track, and cleanly terminate multi-host MPI jobs. PBS users can run an MPI job within a specific partition.

If CSA has been configured and enabled, PBS will collect accounting information on all tasks launched by an MPI job. CSA information will be associated with the PBS job ID that invoked it, on each execution host.

If the `PBS_MPI_DEBUG` environment variable's value has a nonzero length, PBS writes debugging information to standard output.

### 2.4.3 Usage

The PBS `mpiexec` command presents the `mpiexec` interface described in section "4.1 Portable MPI Process Startup" of the "MPI-2: Extensions to the Message-Passing Interface" document in <http://www.mpinfo-rum.org/docs/mpi-20-html/node42.htm>

### 2.4.4 Options

`--version`

The `mpiexec` command returns its PBS version information and exits. This option can only be used alone.

### 2.4.5 Requirements

- System running a supported version of HPE MPI.
- PBS uses HPE's `mpirun(1)` command to launch MPI jobs. HPE's `mpirun` must be in the standard location.
- The location of `pbs_attach()` on each vnode of a multi-vnode MPI job must be the same as it is on the primary execution host vnode.
- In order to run multihost jobs, the HPE Array Services must be correctly configured. HPE systems communicating via HPE's Array Services must all use the same version of the `sgi-arraysvcs` package. HPE systems communicating via HPE's Array Services must have been configured to interoperate with each other using the default array. See HPE's `array_services(5)` man page.

## 2.4.6 Environment Variables

### PBS\_ENVIRONMENT

The PBS\_ENVIRONMENT environment variable is used to determine whether `mpiexec` is being called from within a PBS job.

### PBS\_MPI\_DEBUG

The PBS `mpiexec` checks the PBS\_MPI\_DEBUG environment variable. If this variable has a nonzero length, debugging information is written.

### PBS\_O\_PATH

The PBS `mpiexec` uses the value of PBS\_O\_PATH to search for the correct `mpiexec` if it was invoked by mistake.

## 2.4.7 Path

PBS' `mpiexec` is located in `PBS_EXEC/bin/mpiexec`.

## 2.4.8 See Also

The PBS Professional Administrator's Guide, ["pbs\\_attach" on page 58](#)

HPE man pages: HPE's `mpirun(1)`, HPE's `mpiexec_mpt(1)`, HPE's `array_services(5)`

---

## 2.5 pbs

Start, stop, restart, or get the PIDs of PBS daemons

### 2.5.1 Synopsis

*pbs [start | stop | restart | status]*

### 2.5.2 Description

The `pbs` command starts, stops or restarts all PBS daemons on the local machine, or reports the PIDs of all daemons when given the *status* argument. Does not affect other hosts.

You can start, stop, restart, or status the PBS daemons using the `systemctl` command; see [“Starting & Stopping PBS on Linux” on page 131 in the PBS Professional Installation & Upgrade Guide](#).

#### 2.5.2.1 Caveats

This command operates only on daemons that are marked as active in `pbs.conf`. For example, if `PBS_START_MOM` is set to `0` in the local `pbs.conf`, this command will not operate on `pbs_mom`, and will not start, stop, or restart `pbs_mom`.

This command is typically placed in `/etc/init.d` so that PBS starts up automatically.

#### 2.5.2.2 Required Privilege

You need root privilege to use this command to start, stop, or restart PBS daemons.

A non-root user can use this command to get the PIDs of PBS daemons.

### 2.5.3 Arguments

#### restart

All daemons on the local machine are stopped, then they are restarted. PBS reports the name of the license server and the number and type of licenses available.

#### start

Each daemon on the local machine is started. PBS reports the number and type of licenses available, as well as the name of the license server. Any running jobs are killed.

#### status

PBS reports the PID of each daemon on the local machine.

#### stop

Each daemon on the local machine is stopped, and its PID is reported.

### 2.5.4 See Also

The PBS Professional Administrator's Guide, [“pbs comm” on page 61](#), [“pbs mom” on page 74](#), [“pbs sched” on page 108](#), [“pbs server” on page 110](#)

## 2.6 pbsdsh

Distributes tasks to vnodes under PBS

### 2.6.1 Synopsis

```
pbsdsh [-c <copies>] [-s] [-v] [-o] -- <program> [<program args>]
pbsdsh [-n <vnode index>] [-s] [-v] [-o] -- <program> [<program args>]
pbsdsh --version
```

### 2.6.2 Description of pbsdsh Command

The **pbsdsh** command allows you to distribute and execute a task on each of the vnodes assigned to your job by executing (spawning) the application on each vnode. The **pbsdsh** command uses the PBS Task Manager, or TM, to distribute the program on the allocated vnodes.

When run without the **-c** or the **-n** option, **pbsdsh** will spawn the program on all vnodes allocated to the PBS job. The spawns take place concurrently; all execute at (about) the same time.

Note that the double dash must come after the options and before the program and arguments. The double dash is only required for Linux.

The **pbsdsh** command runs one task for each entry in the job's `exec_host` attribute.

#### 2.6.2.1 Example

The following example shows the **pbsdsh** command inside of a PBS batch job. The options indicate that the user wants **pbsdsh** to run the *myapp* program with one argument (*app-arg1*) on all four vnodes allocated to the job (i.e. the default behavior).

```
#!/bin/sh
#PBS -l select=4:ncpus=1
#PBS -l walltime=1:00:00

pbsdsh ./myapp app-arg1
```

### 2.6.3 Options to pbsdsh Command

#### -c <copies>

The program is spawned *copies* times on the vnodes allocated, one per vnode, unless *copies* is greater than the number of vnodes. If *copies* is greater than the number of vnodes, it wraps around, running multiple instances on some vnodes. This option is mutually exclusive with **-n**.

#### -n <vnode index>

The program is spawned only on a single vnode, which is the *vnode index*-th vnode allocated. This option is mutually exclusive with **-c**.

#### -o

No obit request is made for spawned tasks. The program does not wait for the tasks to finish.

#### -s

The program is run in turn on each vnode, one after the other.

-v

Produces verbose output about error conditions and task exit status.

--version

The `pbsdsh` command returns its PBS version information and exits. This option can only be used alone

## 2.6.4 Operands

program

The first operand, *program*, is the program to execute. The double dash must precede *program* under Linux.

program args

Additional operands, *program args*, are passed as arguments to the program.

## 2.6.5 Standard Error

The `pbsdsh` command writes a diagnostic message to standard error for each error occurrence.

## 2.6.6 Caveats

The `pbsdsh` command does not check for host availability. This can lead to the following problems:

- If you run `pbsdsh` while one of the hosts is down, `pbsdsh` enters an infinite loop
- If you restart the primary execution host while `pbsdsh` is running, `pbsdsh` exits with an error because it loses connection with MoM on the primary
- Starting `pbsdsh` right after a host restart may result in an error on task spawn because the task can be sent to the host before the host rejoins the job (and receives ports through which it should communicate)

## 2.6.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["qsub" on page 221](#), ["Task Management API" on page 93 in the PBS Professional Programmer's Guide](#)

## 2.7 pbsfs

Show or manipulate PBS fairshare usage data

### 2.7.1 Synopsis

Showing usage data:

```
pbsfs [-c <entity1> <entity2>] [-g <entity>] [-I <scheduler name>] [-p] [-t]
```

Manipulating usage data:

```
pbsfs [-d] [-e] [-I <scheduler name>] [-s <entity> <usage value>]
```

Printing version:

```
pbsfs --version
```

### 2.7.2 Description

You can use the `pbsfs` command to print or manipulate a PBS scheduler's fairshare usage data. You can print the usage data in various formats, described below. Changes made using `pbsfs` take effect in the next scheduling cycle; you do not need to restart or HUP a scheduler for changes to take effect.

We recommend that if you use the options that manipulate usage data, you should do this when a scheduler is not scheduling jobs, because scheduling while changing fairshare usage data may give unwanted results.

#### 2.7.2.1 Prerequisites

The server must be running in order to use the `pbsfs` command.

#### 2.7.2.2 Permissions

You must be root to run the `pbsfs` command; if not, it will print the error message, "Unable to access fairshare data".

### 2.7.3 Options to pbsfs

*You can safely use the following options while jobs are being scheduled:*

(no options)

Same as `pbsfs -p`.

`-c <entity1> <entity2>`

Compares two fairshare entities.

`-g <entity>`

Prints a detailed listing for the specified entity, including the path from the root of the tree to the entity.

`-I <scheduler name>`

Specifies name of scheduler whose data is to be manipulated or shown. Required for multischeds; optional for default scheduler. Name of default scheduler is "default". If not specified, `pbsfs` operates on default scheduler.

**-p**

Prints the fairshare tree as a table, showing for each internal and leaf vertex the group ID of the vertex's parent, group ID of the vertex, vertex shares, vertex usage, and percent of shares allotted to the vertex.

**-t**

Prints the fairshare tree in a hierarchical format.

**--version**

The `pbsfs` command returns its PBS version information and exits. This option can only be used alone.

It is not recommended to be scheduling jobs when you use the following options:

**-d**

Decays the fairshare tree by the amount specified in the `fairshare_decay_factor` scheduler parameter.

**-e**

Trims fairshare tree to just the entities in the `resource_group` file. Unknown entities and their usage are deleted; as a result the unknown group has no usage and no children.

**-s <entity> <usage value>**

Sets *entity*'s usage value to *usage value*. Editing a non-leaf entity is ignored. All non-leaf entity usage values are calculated each time you use the `pbsfs` command to make changes.

### 2.7.3.1 Output Formats for `pbsfs`

The `pbsfs` command can print output in three different formats:

**`pbsfs -g <entity>`**

Prints a detailed listing for the specified entity. Example:

```
pbsfs -g pbsuser3
fairshare entity: pbsuser3
Resgroup: 20
cresgroup: 22
Shares: 40
Percentage: 24.000000%
fairshare_tree_usage: 0.832973
usage: 1000 (cput)
usage/perc: 4167
Path from root:
TREERoot :    0      1201 / 1.000 = 1201
group2    :    20      1001 / 0.600 = 1668
pbsuser3  :    22      1000 / 0.240 = 4167
```

***pbsfs***,

***pbsfs -p***

Prints the entire tree as a table, with data in columns. Example:

***pbsfs***

Fairshare usage units are in: cput

|          |           |          |            |             |                |
|----------|-----------|----------|------------|-------------|----------------|
| TREEROOT | : Grp: -1 | cgrp: 0  | Shares: -1 | Usage: 1201 | Perc: 100.000% |
| group2   | : Grp: 0  | cgrp: 20 | Shares: 60 | Usage: 1001 | Perc: 60.000%  |
| pbsuser3 | : Grp: 20 | cgrp: 22 | Shares: 40 | Usage: 1000 | Perc: 24.000%  |
| pbsuser2 | : Grp: 20 | cgrp: 21 | Shares: 60 | Usage: 1    | Perc: 36.000%  |
| group1   | : Grp: 0  | cgrp: 10 | Shares: 40 | Usage: 201  | Perc: 40.000%  |
| pbsuser1 | : Grp: 10 | cgrp: 12 | Shares: 50 | Usage: 100  | Perc: 20.000%  |
| pbsuser  | : Grp: 10 | cgrp: 11 | Shares: 50 | Usage: 100  | Perc: 20.000%  |
| unknown  | : Grp: 0  | cgrp: 1  | Shares: 0  | Usage: 1    | Perc: 0.000%   |

***pbsfs -t***

Prints the entire tree as a tree, showing group-child relationships. Example:

***pbsfs -t***

```

TREEROOT(0)
  group2(20)
    pbsuser3(22)
    pbsuser2(21)
  group1(10)
    pbsuser1(12)
    pbsuser(11)
  unknown(1)

```

### 2.7.3.2 Data Output by pbsfs

**cresgroup, cgrp**

Group ID of the entity

**fairshare entity**

The specified fairshare tree entity

**fairshare usage units**

The resource for which a scheduler accumulates usage for fairshare calculations. This defaults to *cput* (CPU seconds) but can be set in a scheduler's configuration file.

**fairshare\_tree\_usage**

The entity's effective usage. See ["Computing Effective Usage \(fairshare\\_tree\\_usage\)" on page 147 in the PBS Professional Administrator's Guide](#).

**Path from root**

The path from the root of the tree to the entity. A scheduler follows this path when comparing priority between two entities.

**Percentage, perc**

The percentage of the shares in the tree allotted to the entity, computed as *fairshare\_perc*. See ["Computing Target Usage for Each Vertex \(fairshare\\_perc\)" on page 147 in the PBS Professional Administrator's Guide](#).

**Resgroup, Grp**

Group ID of the entity's parent group



---

**Shares**

The number of shares allotted to the entity

**usage**

The amount of usage by the entity

**usage/perc**

The value a scheduler uses to pick which entity has priority over another. The smaller the number the higher the priority.

## 2.7.4 See Also

["Using Fairshare" on page 141 in the PBS Professional Administrator's Guide.](#)

## 2.8 pbsnodes

Query PBS host or vnode status, mark hosts free or offline, change the comment for a host, or output vnode information

### 2.8.1 Synopsis

```
pbsnodes [-o | -r] [-s <server name>] [-C <comment>] <hostname> [<hostname> ...]
pbsnodes [-l] [-s <server name>]
pbsnodes -v <vnode> [<vnode> ...] [-s <server name>]
pbsnodes -a[v] [-S[j][L]] [-F json|dsv [-D <delimiter>]] [-s <server name>]
pbsnodes [-H] [-S[j][L]] [-F json|dsv [-D <delimiter>]] <hostname> [<hostname> ...]
pbsnodes --version
```

### 2.8.2 Description

The `pbsnodes` command is used to query the status of hosts or vnodes, to mark hosts *FREE* or *OFFLINE*, to edit a host's `comment` attribute, or to output vnode information. The `pbsnodes` command obtains host information by sending a request to the PBS server.

#### 2.8.2.1 Using pbsnodes

To list all vnodes:

```
pbsnodes -av
```

To print the status of the specified host or hosts, run `pbsnodes` with no options (except the `-s` option) and with a list of hosts.

To print the command usage, run `pbsnodes` with no options and without a list of hosts.

To remove a vnode from the scheduling pool, mark it *OFFLINE*. If it is marked *DOWN*, when the server next queries the MoM, and can connect, the vnode will be marked *FREE*.

To offline a single vnode in a multi-vnoded system, use:

```
qmgr -c "set node <vnode name> state=offline"
```

#### 2.8.2.2 Output

The order in which hosts or vnodes are listed in the output of the `pbsnodes` command is undefined. Do not rely on output being ordered.

If you print attributes, `pbsnodes` prints out only those attributes which are not at default values.

#### 2.8.2.3 Permissions

PBS Manager or Operator privilege is required to execute `pbsnodes` with the `-o` or `-r` options, to view custom resources which have been created to be invisible to users, and to see some output such as PBS version.

## 2.8.3 Options to `pbsnodes`

(no options)

If neither options nor a host list is given, the `pbsnodes` command prints usage syntax.

**-a**

Lists all hosts and all their attributes (available and used.)

When used with the `-v` option, lists all vnodes.

When listing a host with multiple vnodes:

The output for the `jobs` attribute lists all the jobs on all the vnodes on that host. Jobs that run on more than one vnode will appear once for each vnode they run on.

For consumable resources, the output for each resource is the sum of that resource across all vnodes on that host.

For all other resources, e.g. string and Boolean, if the value of that resource is the same on all vnodes on that host, the value is returned. Otherwise the output is the literal string "`<various>`".

**-C <comment>**

Sets the `comment` attribute for the specified host(s) to the value of *comment*. Comments containing spaces must be quoted. The comment string is limited to 80 characters. Usage:

```
pbsnodes -C <comment> <hostname> [<hostname> ...]
```

To set the comment for a vnode:

```
qmgr -c "s n <vnode name> comment=<comment>"
```

**-F dsv [-D <delimiter>]**

Prints output in delimiter-separated value format. Optional delimiter specification. Default delimiter is vertical bar ("`|`").

**-F json**

Prints output in JSON format.

**-H <hostname> [<hostname> ...]**

Prints all non-default-valued attributes for specified hosts and all vnodes on specified hosts.

**-j**

Displays the following job-related headers for specified vnodes:

**Table 2-2: Output for -j Option**

| Header           | Width          | Description                        |
|------------------|----------------|------------------------------------|
| <i>vnnode</i>    | 15             | Vnode name                         |
| <i>state</i>     | 15             | Vnode state                        |
| <i>njobs</i>     | 6              | Number of jobs on vnode            |
| <i>run</i>       | 5              | Number of running jobs at vnode    |
| <i>susp</i>      | 6              | Number of suspended jobs at vnode  |
| <i>mem f/t</i>   | 12             | Vnode memory free/total            |
| <i>ncpus f/t</i> | 7              | Number of CPUs at vnode free/total |
| <i>ngpus f/t</i> | 7              | Number of GPUs at vnode free/total |
| <i>jobs</i>      | No restriction | List of job IDs on vnode           |

Each subjob is treated as a unique job.

**-L**

Displays output with no restrictions on column width.

**-l**

Lists all hosts marked as *DOWN* or *OFFLINE*. Each such host's state and *comment* attribute (if set) is listed. If a host also has state *STATE-UNKNOWN*, it is listed. For hosts with multiple vnodes, only hosts where all vnodes are marked as *DOWN* or *OFFLINE* are listed.

**-o <hostname> [<hostname> ...]**

Marks listed hosts as *OFFLINE* even if currently in use. This is different from being marked *DOWN*. A host that is marked *OFFLINE* continues to execute the jobs already on it, but is removed from the scheduling pool (no more jobs are scheduled on it.)

For hosts with multiple vnodes, *pbsnodes* operates on a host and all of its vnodes, where the hostname is *resources\_available.host*, which is the name of the parent vnode.

To offline all vnodes on a multi-vnoded machine:

```
pbsnodes -o <name of parent vnode>
```

To offline a single vnode on a multi-vnoded system, use:

```
qmgr: qmgr -c "set node <vnode name> state=offline"
```

Requires PBS Manager or Operator privilege.

**-r <hostname> [<hostname> ...]**

Clears *OFFLINE* from listed hosts.

**-S**

Displays the following vnode information:

**Table 2-3: Output for -S Option**

| Header          | Width          | Description                                      |
|-----------------|----------------|--|
| <i>name</i>     | 15             | Vnode name                                       |
| <i>state</i>    | 15             | Vnode state                                      |
| <i>OS</i>       | 8              | Value of <b>OS</b> custom resource, if any       |
| <i>hardware</i> | 8              | Value of <b>hardware</b> custom resource, if any |
| <i>host</i>     | 15             | Hostname   |
| <i>queue</i>    | 10             | Value of vnode's <b>queue</b> attribute          |
| <i>n_cpus</i>   | 7              | Number of CPUs at vnode                          |
| <i>mem</i>      | 8              | Vnode memory                                     |
| <i>ngpus</i>    | 7              | Number of GPUs at vnode                          |
| <i>comment</i>  | No restriction | Vnode comment                                    |

Note that **OS** is a custom resource that must be created by the administrator if you want its values displayed here.

**-s <server name>**

Specifies the PBS server to which to connect.

**-v [<vnode> [<vnode> ...]]**

Lists all non-default-valued attributes for each specified vnode.

With no arguments, prints one entry for each vnode in the PBS complex.

With one or more vnodes specified, prints one entry for each specified vnode.

When used with **-a**, lists all vnodes.

**--version**

The **pbsnodes** command returns its PBS version information and exits. This option can only be used alone.

## 2.8.4 Operands

**<server name>**

Specifies the server to which to connect. Default: default server.

**<hostname> [<hostname> ...]**

Specifies the host(s) to be queried or operated on.

**<vnode> [<vnode> ...]**

Specifies the vnode(s) to be queried or operated on.

## 2.8.5 Exit Status

Zero

Success

Greater than zero

- Incorrect operands are given
- `pbsnodes` cannot connect to the server
- There is an error querying the server for the vnodes

## 2.8.6 See Also

The PBS Professional Administrator's Guide, ["qmgr" on page 157](#)

## 2.9 pbsrun

General-purpose wrapper script for `mpirun`

### 2.9.1 Synopsis

`pbsrun`

`pbsrun --version`

### 2.9.2 Description

`pbsrun` is a wrapper script for any of several versions of `mpirun`. This provides a user-transparent way for PBS to control jobs which call `mpirun` in their job scripts. The `pbsrun_wrap` script instantiates `pbsrun` so that the wrapper script for the specific version of `mpirun` being used has the same name as that version of `mpirun`.

If the `mpirun` wrapper script is run inside a PBS job, it translates any `mpirun` call of the form:

```
mpirun [<options>] <executable> [<args>]
```

into

```
mpirun [<options>] pbs_attach [<special options to pbs_attach>] <executable> [<args>]
```

where *special options* refers to any option needed by `pbs_attach` to do its job (e.g. `-j $PBS_JOBID`).

If the wrapper script is executed outside of PBS, a warning is issued about "not running under PBS", but it proceeds as if the actual program had been called in standalone fashion.

The `pbsrun` wrapper script is not meant to be executed directly; instead it is instantiated by `pbsrun_wrap`. It is copied to the target directory and renamed "`pbsrun.<mpirun version/flavor>`" where *mpirun version/flavor* is a string that identifies the `mpirun` version being wrapped (e.g. `ch_gm`).

The `pbsrun` script, if executed inside a PBS job, runs an initialization script, named `$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.init`, then parses `mpirun`-like arguments from the command line, sorting which options and option values to retain, to ignore, or to transform, before calling the actual `mpirun` script with a "`pbs_attach`" prefixed to the executable. The actual `mpirun` to call is found by tracing the link pointed to by `$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.link`.

For all of the wrapped MPIs, the maximum number of ranks that can be launched is the number of entries in `$PBS_NODEFILE`.

The wrapped MPIs are:

- MPICH-GM's `mpirun` (`mpirun.ch_gm`) with `rsh/ssh` (The wrapper is **deprecated** as of 14.2.1)
- MPICH-MX's `mpirun` (`mpirun.ch_mx`) with `rsh/ssh` (The wrapper is **deprecated** as of 14.2.1)
- MPICH-GM's `mpirun` (`mpirun.mpd`) with `MPD` (The wrapper is **deprecated** as of 14.2.1)
- MPICH-MX's `mpirun` (`mpirun.mpd`) with `MPD` (The wrapper is **deprecated** as of 14.2.1)
- MPICH2's `mpirun`
- Intel MPI's `mpirun` (The wrapper is **deprecated** as of 13.0)
- MVAPICH1's `mpirun` (The wrapper is **deprecated** as of 14.2.1)
- MVAPICH2's `mpiexec`

## 2.9.3 Options

### --version

The `pbsrun` command returns its PBS version information and exits. This option can only be used alone.

## 2.9.4 Initialization Script

The initialization script, called `$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.init`, where *mpirun version/flavor* reflects the `mpirun` flavor/version being wrapped, can be modified by an administrator to customize against the local flavor/version of `mpirun` being wrapped.

Inside this sourced init script, 8 variables are set:

```
options_to_retain="-optA -optB <val> -optC <val1> val2> ..."
options_to_ignore="-optD -optE <n> -optF <val1> val2> ..."
options_to_transform="-optG -optH <val> -optI <val1> val2> ..."
options_to_fail="-optY -optZ ..."
options_to_configfile="-optX <val> ..."
options_with_another_form="-optW <val> ..."
pbs_attach=pbs_attach
options_to_pbs_attach="-J $PBS_JOBID"
```

### 2.9.4.1 Initialization Script Options

#### options\_to\_retain

Space-separated list of options and values that `pbsrun.<mpirun version/flavor>` passes on to the actual `mpirun` call. Options must begin with "-" or "--", and option arguments must be specified by some arbitrary name with left and right arrows, as in "<val1>".

#### options\_to\_ignore

Space-separated list of options and values that `pbsrun.<mpirun version/flavor>` does not pass on to the actual `mpirun` call. Options must begin with "-" or "--", and option arguments must be specified by arbitrary names with left and right arrows, as in "<n>".

#### options\_to\_transform

Space-separated list of options and values that `pbsrun` modifies before passing on to the actual `mpirun` call.

#### options\_to\_fail

Space-separated list of options that will cause `pbsrun` to exit upon encountering a match.

#### options\_to\_configfile

Single option and value that refers to the name of the configuration file containing command line segments found in certain versions of `mpirun`.

#### options\_with\_another\_form

Space-separated list of options and values that can be found in *options\_to\_retain*, *options\_to\_ignore*, or *options\_to\_transform*, whose syntax has an alternate, unsupported form.

#### pbs\_attach

Path to `pbs_attach`, which is called before the *executable* argument of `mpirun`.

#### options\_to\_pbs\_attach

Special options to pass to the `pbs_attach` call. You may pass variable references (e.g. `$PBS_JOBID`) and they are substituted by `pbsrun` to actual values.



If `pbsrun` encounters any option not found in *options\_to\_retain*, *options\_to\_ignore*, and *options\_to\_transform*, it is flagged as an error.

These functions are created inside the `init` script. These can be modified by the PBS administrator.

```
transform_action () {
# passed actual values of $options_to_transform
args=$*
}
```

```
boot_action () {
mpirun_location=$1
}
```

```
evaluate_options_action () {
# passed actual values of transformed options
args=$*
}
```

```
configfile_cmdline_action () {
args=$*
}
```

```
end_action () {
mpirun_location=$1
}
```

### transform\_action()

The `pbsrun.<mpirun version/flavor>` wrapper script invokes the function `transform_action()` (called once on each matched item and value) with actual options and values received matching one of the *options\_to\_transform*. The function returns a string to pass on to the actual `mpirun` call.

### boot\_action()

Performs any initialization tasks needed before running the actual `mpirun` call. For instance, GM's MPD requires the MPD daemons to be user-started first. This function is called by the `pbsrun.<mpirun version/flavor>` script with the location of actual `mpirun` passed as the first argument. Also, the `pbsrun.<mpirun version/flavor>` checks for the exit value of this function to determine whether or not to progress to the next step.

### evaluate\_options\_action()

Called with the actual options and values that resulted after consulting *options\_to\_retain*, *options\_to\_ignore*, *options\_to\_transform*, and executing `transform_action()`. This provides one more chance for the script writer to evaluate all the options and values in general, and make any necessary adjustments, before passing them on to the actual `mpirun` call. For instance, this function can specify what the default value is for a missing `-np` option.

**configfile\_cmdline\_action()**

Returns the actual options and values to be put in before the *option\_to\_configfile* parameter.

**configfile\_firstline\_action()**

Returns the item that is put in the first line of the configuration file specified in the *option\_to\_configfile* parameter.

**end\_action()**

Called by `pbsrun.<mpirun version/flavor>` at the end of execution. It undoes any action done by `transform_action()`, such as cleanup of temporary files. It is also called when `pbsrun.<mpirun version/flavor>` is prematurely killed. This function is called with the location of actual `mpirun` passed as first argument.

The actual `mpirun` program to call is the path pointed to by `$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.link`.

### 2.9.4.2 Modifying \*.init Scripts

In order for administrators to modify `*.init` scripts without breaking package verification in RPM, master copies of the initialization scripts are named `*.init.in`. `pbsrun_wrap` instantiates the `*.init.in` files as `*.init`. For instance, `$PBS_EXEC/lib/MPI/pbsrun.mpich2.init.in` is the master copy, and `pbsrun_wrap` instantiates it as `$PBS_EXEC/lib/MPI/pbsrun.mpich2.init`. `pbsrun_unwrap` takes care of removing the `*.init` files.

## 2.9.5 Versions/Flavors of mpirun

### 2.9.5.1 MPICH-GM mpirun (mpirun.ch\_gm) with rsh/ssh: pbsrun.ch\_gm

#### 2.9.5.1.i Syntax

`pbsrun.ch_gm <options> <executable> <arg1> <arg2> ... <argn>`

**Deprecated.** The PBS wrapper script to MPICH-GM's `mpirun (mpirun.ch_gm)` with `rsh/ssh` process startup method is named `pbsrun.ch_gm`.

If executed inside a PBS job, this allows for PBS to track all MPICH-GM processes started by `rsh/ssh` so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpirun.ch_gm` were used.

#### 2.9.5.1.ii Options Handling

If executed inside a PBS job script, all `mpirun.ch_gm` options given are passed on to the actual `mpirun` call with these exceptions:

**-machinefile <file>**

The *file* argument contents are ignored and replaced by the contents of `$PBS_NODEFILE`.

**-np**

If not specified, the number of entries found in `$PBS_NODEFILE` is used.

**-pg**

The use of the `-pg` option, for having multiple executables on multiple hosts, is allowed but it is up to the user to make sure only PBS hosts are specified in the process group file; MPI processes spawned are not guaranteed to be under the control of PBS.

### 2.9.5.1.iii Wrap/Unwrap

To wrap MPICH-GM's `mpirun` script:

```
# pbsrun_wrap [MPICH-GM_BIN_PATH]/mpirun.ch_gm pbsrun.ch_gm
```

To unwrap MPICH-GM's `mpirun` script:

```
# pbsrun_unwrap pbsrun.ch_gm
```

## 2.9.5.2 MPICH-MX `mpirun` (`mpirun.ch_mx`) with `rsh/ssh`: `pbsrun.ch_mx`

### 2.9.5.2.i Syntax

```
pbsrun.ch_mx <options> <executable> <arg1> <arg2> ... <argn>
```

The wrapper is **deprecated**. The PBS wrapper script to MPICH-MX's `mpirun` (`mpirun.ch_gm`) with `rsh/ssh` process startup method is named `pbsrun.ch_mx`.

If executed inside a PBS job, this allows PBS to track all MPICH-MX processes started by `rsh/ssh` so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpirun.ch_mx` were used.

### 2.9.5.2.ii Options Handling

If executed inside a PBS job script, all `mpirun.ch_gm` options given are passed on to the actual `mpirun` call with some exceptions:

**-machinefile** <file>

The *file* argument contents is ignored and replaced by the contents of `$PBS_NODEFILE`.

**-np**

If not specified, the number of entries found in `$PBS_NODEFILE` is used.

**-pg**

The use of the `-pg` option, for having multiple executables on multiple hosts, is allowed but it is up to the user to make sure only PBS hosts are specified in the process group file; MPI processes spawned are not guaranteed to be under the control of PBS.

### 2.9.5.2.iii Wrap/Unwrap

To wrap MPICH-MX's `mpirun` script:

```
# pbsrun_wrap [MPICH-MX_BIN_PATH]/mpirun.ch_mx pbsrun.ch_mx
```

To unwrap MPICH-MX's `mpirun` script:

```
# pbsrun_unwrap pbsrun.ch_mx
```

## 2.9.5.3 MPICH-GM `mpirun` (`mpirun.mpd`) with MPD: `pbsrun.gm_mpd`

### 2.9.5.3.i Syntax

```
pbsrun.gm_mpd <options> <executable> <arg1> <arg2> ... <argn>
```

The wrapper is **deprecated**. The PBS wrapper script to MPICH-GM's `mpirun` (`mpirun.ch_gm`) with MPD process startup method is called `pbsrun.gm_mpd`.

If executed inside a PBS job, this allows PBS to track all MPICH-GM processes started by the MPD daemons so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpirun.ch_gm` with MPD were used.

### 2.9.5.3.ii Options Handling

If executed inside a PBS job script, all `mpirun.ch_gm` with MPD options given are passed on to the actual `mpirun` call with these exceptions:

**-m <file>**

The *file* argument contents are ignored and replaced by the contents of `$PBS_NODEFILE`.

**-np**

If not specified, the number of entries found in `$PBS_NODEFILE` is used.

**-pg**

The use of the `-pg` option, for having multiple executables on multiple hosts, is allowed but it is up to the user to make sure only PBS hosts are specified in the process group file; MPI processes spawned are not guaranteed to be under the control of PBS.

### 2.9.5.3.iii Startup/Shutdown

The script starts MPD daemons on each of the unique hosts listed in `$PBS_NODEFILE`, using either `rsh` or `ssh` based on the value of the environment variable `RSHCOMMAND`. The default is `rsh`.

The script also takes care of shutting down the MPD daemons at the end of a run.

### 2.9.5.3.iv Wrap/Unwrap

To wrap MPICH-GM's `mpirun` script with MPD:

```
# pbsrun_wrap [MPICH-GM_BIN_PATH]/mpirun.mpd pbsrun.gm_mpd
```

To unwrap MPICH-GM's `mpirun` script with MPD:

```
# pbsrun_unwrap pbsrun.gm_mpd
```

## 2.9.5.4 MPICH-MX `mpirun` (`mpirun.mpd`) with MPD: `pbsrun.mx_mpd`

### 2.9.5.4.i Syntax

```
pbsrun.mx_mpd <options> <executable> <arg1> <arg2> ... <argn>
```

The wrapper is **deprecated**. The PBS wrapper script to MPICH-MX's `mpirun` (`mpirun.ch_mx`) with MPD process startup method is called `pbsrun.mx_mpd`.

If executed inside a PBS job, this allows PBS to track all MPICH-MX processes started by the MPD daemons so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpirun.ch_mx` with MPD were used.

### 2.9.5.4.ii Options Handling

If executed inside a PBS job script, all `mpirun.mx_mpd` with MPD options given are passed on to the actual `mpirun` call with these exceptions:

**-m <file>**

The *file* argument contents are ignored and replaced by the contents of `$PBS_NODEFILE`.

**-np**

If not specified, the number of entries found in `$PBS_NODEFILE` is used.

**-pg**

The use of the `-pg` option, for having multiple executables on multiple hosts, is allowed but it is up to the user to make sure only PBS hosts are specified in the process group file; MPI processes spawned are not guaranteed to be under the control of PBS.

### 2.9.5.4.iii Startup/Shutdown

The script starts MPD daemons on each of the unique hosts listed in `$PBS_NODEFILE`, using either `rsh` or `ssh`, based on the value of the environment variable `RSHCOMMAND`. The default is `rsh`.

The script also takes care of shutting down the MPD daemons at the end of a run.

### 2.9.5.4.iv Wrap/Unwrap

To wrap MPICH-MX's `mpirun` script with MPD:

```
# pbsrun_wrap [MPICH-MX_BIN_PATH]/mpirun.mpd pbsrun.mx_mpd
```

To unwrap MPICH-MX's `mpirun` script with MPD:

```
# pbsrun_unwrap pbsrun.mx_mpd
```

## 2.9.5.5 MPICH2 `mpirun`: `pbsrun.mpich2`

### 2.9.5.5.i Syntax

```
pbsrun.mpich2 [<global args>] [<local args>] <executable> [<args>] [: [<local args>] <executable> [<args>]]
```

- or -

```
pbsrun.mpich2 -configfile <configfile>
```

where *configfile* contains command line segments as lines:

```
[local args] executable1 [args]
```

```
[local args] executable2 [args]
```

```
[local args] executable3 [args]
```

The PBS wrapper script to MPICH2's `mpirun` is called `pbsrun.mpich2`.

If executed inside a PBS job, this allows PBS to track all MPICH2 processes so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard MPICH2's `mpirun` were used.

### 2.9.5.5.ii Options Handling

If executed inside a PBS job script, all MPICH2's `mpirun` options given are passed on to the actual `mpirun` call with these exceptions:

#### -host and -ghost

For specifying the execution host to run on. Not passed on to the actual `mpirun` call.

#### -machinefile <file>

The *file* argument contents are ignored and replaced by the contents of `$PBS_NODEFILE`.

#### MPICH2's `mpirun` -localonly <num processes>

For specifying number of processes to run locally. Not supported. The user is advised instead to use the equivalent arguments: `-np <num processes> -localonly`. The reason for this is that the `pbsrun` wrapper script cannot handle a variable number of arguments to an option (e.g. `"-localonly"` has one argument and `"-localonly <num processes>"` has two arguments).

#### -np

If the user does not specify the `-np` option, no default value is provided by the PBS wrapper scripts. It is up to the local `mpirun` to decide what the reasonable default value should be, which is usually `1`.

### 2.9.5.5.iii Startup/Shutdown

The script takes care of ensuring that the MPD daemons on each of the hosts listed in `$PBS_NODEFILE` are started. It also takes care of ensuring that the MPD daemons have been shut down at the end of MPI job execution.

### 2.9.5.5.iv Wrap/Unwrap

To wrap MPICH2's `mpirun` script:

```
# pbsrun_wrap [<MPICH2 BIN PATH>]/mpirun pbsrun.mpich2
```

To unwrap MPICH2's `mpirun` script:

```
# pbsrun_unwrap pbsrun.mpich2
```

In the case where MPICH2 uses `mpirun.py`, run `pbsrun_wrap` on `mpirun.py` itself.

## 2.9.5.6 Intel MPI `mpirun`: `pbsrun.intelmpi`

Wrapping Intel MPI, and support for `mpdboot`, are **deprecated**.

### 2.9.5.6.i Syntax

```
pbsrun.intelmpi [<mpdboot options>] [<mpiexec options>] <executable> [<prog args>] [: [<mpiexec options>]
<executable> [<prog args>]]
```

- or -

```
pbsrun.intelmpi [<mpdboot options>] -f<configfile>
```

where *mpdboot options* are any options to pass to the `mpdboot` program, which is automatically called by Intel MPI's `mpirun` to start MPDs, and *configfile* contains command line segments as lines.

The PBS wrapper script to Intel MPI's `mpirun` is called `pbsrun.intelmpi`.

If executed inside a PBS job, this allows PBS to track all Intel MPI processes so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard Intel MPI's `mpirun` were used.

### 2.9.5.6.ii Options Handling

If executed inside a PBS job script, all of the options to the PBS interface to Intel MPI's `mpirun` are passed to the actual `mpirun` call with these exceptions:

**-host and -ghost**

For specifying the execution host to run on. Not passed on to the actual `mpirun` call.

**-machinefile <file>**

The *file* argument contents are ignored and replaced by the contents of `$PBS_NODEFILE`.

**mpdboot options --totalnum=\* and --file=\***

Ignored and replaced by the number of unique entries in `$PBS_NODEFILE` and name of `$PBS_NODEFILE` respectively.

**arguments to mpdboot options --file=\* and -f <mpd\_hosts\_file>**

Replaced by `$PBS_NODEFILE`.

**-s**

If `pbsrun.intelmpi` is called inside a PBS job, Intel MPI's `mpirun -s` argument to `mpdboot` is not supported as this closely matches the `mpirun` option `-s <spec>`. The user can simply run a separate `mpdboot -s` before calling `mpirun`. A warning message is issued by `pbsrun.intelmpi` upon encountering a `-s` option telling users of the supported form.

**-np**

If the user does not specify the `-np` option, no default value is provided by the PBS wrap scripts. It is up to the local `mpirun` to decide what the reasonable default value should be, which is usually `1`.

### 2.9.5.6.iii Startup/Shutdown

Intel MPI's `mpirun` itself takes care of starting/stopping the MPD daemons. `pbsrun.intelmpi` always passes the arguments `-totalnum=<number of mpds to start>` and `-file=<mpd_hosts_file>` to the actual `mpirun`, taking its input from unique entries in `$PBS_NODEFILE`.

### 2.9.5.6.iv Wrap/Unwrap

To wrap Intel MPI's `mpirun` script:

```
# pbsrun_wrap [INTEL_MPI_BIN_PATH]/mpirun pbsrun.intelmpi
```

To unwrap Intel MPI's `mpirun` script:

```
# pbsrun_unwrap pbsrun.intelmpi
```

## 2.9.5.7 MVAPICH1 mpirun: pbsrun.mvapich1

### 2.9.5.7.i Syntax

```
pbsrun.mvapich1 <mpirun options> <executable> <options>
```

The wrapper is **deprecated**. The PBS wrapper script to MVAPICH1's `mpirun` is called `pbsrun.mvapich1`.

Only one executable can be specified. MVAPICH1 allows the use of InfiniBand.

If executed inside a PBS job, this allows PBS to be aware of all MVAPICH1 ranks and to track their resources, so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpirun` were used.

### 2.9.5.7.ii Options Handling

If executed inside a PBS job script, all `mpirun` options given are passed on to the actual `mpirun` call with these exceptions:

**-map <list>**

The `map` option is ignored.

**-exclude <list>**

The `exclude` option is ignored.

**-machinefile <file>**

The `machinefile` option is ignored.

**-np**

If not specified, the number of entries found in `$PBS_NODEFILE` is used.

### 2.9.5.7.iii Wrap/Unwrap

To wrap MVAPICH1's `mpirun` script:

```
# pbsrun_wrap <path-to-actual-mpirun> pbsrun.mvapich1
```

To unwrap MVAPICH1's `mpirun` script:

```
# pbsrun_unwrap pbsrun.mvapich1
```

### 2.9.5.8 MVAPICH2 `mpiexec`: `pbsrun.mvapich2`

#### 2.9.5.8.i Syntax

```
pbsrun.mvapich2 <mpiexec args> <executable> <executable's args> [: <mpiexec args> <executable> <executable's args>]
```

The PBS wrapper script to MVAPICH2's `mpiexec` is called `pbsrun.mvapich2`.

Multiple executables can be specified using the colon notation. MVAPICH2 allows the use of InfiniBand.

If executed inside a PBS job, this allows PBS to be aware of all MVAPICH2 ranks and to track their resources, so that PBS can perform accounting and have complete job control.

If executed outside of a PBS job, it behaves exactly as if standard `mpiexec` were used.

#### 2.9.5.8.ii Options Handling

If executed inside a PBS job script, all `mpiexec` options given are passed on to the actual `mpiexec` call with these exceptions:

`-host <hostname>`

The *hostname* argument contents are ignored.

`-machinefile <file>`

The *file* argument contents are ignored and replaced by the contents of the `$PBS_NODEFILE`.

#### 2.9.5.8.iii Wrap/Unwrap

To wrap MVAPICH2's `mpiexec` script:

```
# pbsrun_wrap <path-to-actual-mpiexec> pbsrun.mvapich2
```

To unwrap MVAPICH2's `mpiexec` script:

```
# pbsrun_unwrap pbsrun.mvapich2
```

## 2.9.6 Requirements

The `mpirun` being wrapped must be installed and working on all the vnodes in the PBS cluster.

## 2.9.7 Errors

If `pbsrun` encounters any option not found in *options\_to\_retain*, *options\_to\_ignore*, and *options\_to\_transform*, it is flagged as an error.

## 2.9.8 See Also

The PBS Professional Administrator's Guide, ["pbs\\_attach" on page 58](#), ["pbsrun\\_wrap" on page 54](#), ["pbsrun\\_unwrap" on page 53](#)



---

## 2.10 pbsrun\_unwrap

Unwraps `mpirun`, reversing `pbsrun_wrap`

### 2.10.1 Synopsis

*pbsrun\_unwrap pbsrun.<mpirun version/flavor>*

*pbsrun\_unwrap --version*

### 2.10.2 Description

The `pbsrun_unwrap` script is used to reverse the actions of the `pbsrun_wrap` script.

Use `pbsrun_wrap` to wrap `mpirun`.

Using `pbsrun_unwrap` for Intel MPI is **deprecated** as of 13.0.

#### 2.10.2.1 Syntax

*pbsrun\_unwrap pbsrun.<mpirun version/flavor>*

For example, running the following:

```
pbsrun_unwrap pbsrun.ch_gm
```

causes the following actions:

1. Checks for a link in `$PBS_EXEC/lib/MPI/pbsrun.ch_gm.link`; If one exists, get the pathname it points to, for example:  
`/opt/mpich-gm/bin/mpirun.ch_gm.actual`
2. `rm $PBS_EXEC/lib/MPI/pbsrun.mpirun.ch_gm.link`
3. `rm /opt/mpich-gm/bin/mpirun.ch_gm`
4. `rm $PBS_EXEC/bin/pbsrun.ch_gm`
5. `mv /opt/mpich-gm/bin/mpirun.ch_gm.actual /opt/mpich-gm/bin/mpirun.ch_gm`

### 2.10.3 Options

`--version`

The `pbsrun_unwrap` command returns its PBS version information and exits. This option can only be used alone.

### 2.10.4 See Also

The PBS Professional Administrator's Guide, "[pbs\\_attach](#)" on page 58, "[pbsrun\\_wrap](#)" on page 54

## 2.11 pbsrun\_wrap

General-purpose script for wrapping `mpirun` in `pbsrun`

### 2.11.1 Synopsis

```
pbsrun_wrap [-s] <path to actual mpirun> pbsrun.<mpirun version/flavor>
pbsrun_wrap --version
```

### 2.11.2 Description

The `pbsrun_wrap` script is used to wrap any of several versions of `mpirun` in `pbsrun`. The `pbsrun_wrap` script creates a symbolic link with the same path and name as the `mpirun` being wrapped. This calls `pbsrun`, which uses `pbs_attach` to give MoM control of jobs. The result is transparent to the user; when `mpirun` is called from inside a PBS job, PBS can monitor and control the job, but when `mpirun` is called from outside of a PBS job, it behaves as it would normally. See ["pbs\\_attach" on page 58](#).

Use `pbsrun_unwrap` to reverse the process.

Using `pbsrun_wrap` for Intel MPI is **deprecated** as of 13.0.

Available only under Linux.

#### 2.11.2.1 Syntax

```
pbsrun_wrap [-s] <path to actual mpirun> pbsrun.<mpirun version/flavor>
```

Any `mpirun` version/flavor that can be wrapped has an initialization script ending in `".init"`, found in `$PBS_EXEC/lib/MPI`:

```
$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.init
```

The `pbsrun_wrap` script instantiates the `pbsrun` wrapper script as `pbsrun.<mpirun version/flavor>` in the same directory where `pbsrun` is located, and sets up the link to actual `mpirun` call via the symbolic link:

```
$PBS_EXEC/lib/MPI/pbsrun.<mpirun version/flavor>.link
```

For example, running:

```
pbsrun_wrap /opt/mpich-gm/bin/mpirun.ch_gm pbsrun.ch_gm
```

causes the following actions:

1. Save original `mpirun.ch_gm` script:  
`mv /opt/mpich-gm/bin/mpirun.ch_gm /opt/mpich/gm/bin/mpirun.ch_gm.actual`
2. Instantiate `pbsrun` wrapper script as `pbsrun.ch_gm`:  
`cp $PBS_EXEC/bin/pbsrun $PBS_EXEC/bin/pbsrun.ch_gm`
3. Link `"mpirun.ch_gm"` to actually call `"pbsrun.ch_gm"`:  
`ln -s $PBS_EXEC/bin/pbsrun.ch_gm /opt/mpich-gm/bin/mpirun.ch_gm`
4. Create a link so that `"pbsrun.ch_gm"` calls `"mpirun.ch_gm.actual"`:  
`ln -s /opt/mpich-gm/bin/mpirun.ch_gm.actual $PBS_EXEC/lib/MPI/pbsrun.ch_gm.link`

---

### 2.11.3 Options

-s

Sets the "strict\_pbs" options in the various initialization scripts (e.g. `pbsrun.bgl.init`, `pbsrun.ch_gm.init`, etc...) to `1` from the default `0`. This means that the `mpirun` being wrapped by `pbsrun` will only be executed if inside a PBS environment. Otherwise, the user gets the error:

Not running under PBS exiting since strict\_pbs is enabled; execute only in PBS

--version

The `pbsrun_wrap` command returns its PBS version information and exits. This option can only be used alone.

### 2.11.4 Requirements

The `mpirun` being wrapped must be installed and working on all the vnodes in the PBS complex.

### 2.11.5 See Also

The PBS Professional Administrator's Guide, ["pbs\\_attach" on page 58](#), ["pbsrun\\_unwrap" on page 53](#)

## 2.12 pbs\_account

For Windows. Manage PBS service account

### 2.12.1 Synopsis

```
pbs_account [-a <PBS service account name>] [-c [<password>]] [--ci] [--instid <instance ID>] [-o <output path>]
            [-p [<password>]] [--reg <service path>] [-s] [--unreg <service path>]
```

### 2.12.2 Description

The `pbs_account` command is used to manage the PBS service account. It is used to create the account, set or validate the account password, add privileges to the account, and register or unregister the account with the SCM.

#### 2.12.2.1 Permissions

This command can be run by administrators only.

#### 2.12.2.2 Platforms

This command is available on Windows only.

#### 2.12.2.3 Caveats

Using `pbs_account --unreg` and `pbs_account --reg` stops and restarts MoM, which can kill jobs.

### 2.12.3 Options

**-a <account name>**

Specifies service account name.

**-c [<password>]**

- If specified account does not exist, creates the account with the password.
- If specified account exists, validates password against it.

Gives necessary privileges to the specified account: *Create Token Object*, *Replace Process Level Token*, *Log on as a Service*, and *Act as Part of the Operating System*

If password is not specified, user is prompted for password.

**--ci**

Informational only. Prints actions taken by `pbs_account` while creating PBS service account when operations are performed.

**--instid <instance ID>**

Specifies the instance ID when registering or unregistering multiple instances of a service. Example:

```
pbs_account --reg "C:\Program Files (x86)\PBS Pro_2\exec\sbin\pbs_mom" --instid 2 -a <username>
-p <password>
```

```
pbs_account --unreg "C:\Program Files (x86)\PBS Pro_2\exec\sbin\pbs_mom" --instid 2
```

**-o <output path>**

Prints `stdout` and `stderr` messages in specified output path.

---

**-p [<password >]**

Updates the PBS service account password. If no password is specified, the user is prompted for a password.

**--reg <path to service>**

Registers the PBS service with the SCM, instructing it to run the services under the PBS service account. *path to service* must be in double quotes. Restarts MoM.

**-s**

Adds necessary privileges to the PBS service account. Grants the "Create Token Object", "Replace Process Level Token", "Log On as a Service", and "Act as Part of the Operating System" privileges to PBS service account.

**--unreg <path to service>**

Unregisters the PBS service with the SCM. *path to service* must be in double quotes. Stops MoM.

**(no options)**

Prints name of PBS service account, if it exists. Exit value is 0.

## 2.12.4 Examples

Example 2-1: To create the PBS service account:

```
pbs_account -c -s -p <password>
```

Example 2-2: To change the PBS service account:

```
pbs_account --reg <service path> -a <PBS service account name>
```

Example 2-3: To register the MoM service:

```
pbs_account --reg "\\Program Files\\PBS\\exec\\sbin\\pbs_mom.exe" -p <password>
```

## 2.12.5 Exit Value

Zero

Upon success

## 2.13 pbs\_attach

Spawns a process and attaches it to a PBS job, or attaches an existing process to a PBS job

### 2.13.1 Synopsis

#### Spawn and attach on Linux

```
pbs_attach [-j <job ID>] [-m <port number>] [-P] [-s] <cmd> [<arg> ...]
```

#### Attach existing PID on Linux

```
pbs_attach [-j <job ID>] [-m <port number>] -p <PID>
```

#### Spawn and attach on Windows

```
pbs_attach [-c <path to script>] [-j <job ID>] [-m <port number>] [-P] [-s] <cmd> [<arg> ...]
```

#### Attach existing PID on Windows

```
pbs_attach [-c <path to script>] [-j <job ID>] [-m <port number>] -p <PID>
```

#### Get version information on Linux or Windows

```
pbs_attach --version
```

### 2.13.2 Description

The `pbs_attach` command can either spawn a process and attach it to a jobID, or attach an existing process to a job ID.

The `pbs_attach` command associates the processes in a session with a PBS job by attaching the session ID to the job. This allows PBS MoM to monitor and control those processes.

MoM uses process IDs to determine session IDs, which are put into MoM's task list (attached to the job.) All process IDs in a session are then associated with the job.

When a command *cmd* is given as an operand, the `pbs_attach` process becomes the parent process of *cmd*, and the session ID of `pbs_attach` is attached to the job.

#### 2.13.2.1 Setting GPU-related Environment Variables

If your job will spawn a process that needs GPU environment variables, use "`pbs_attach -j $PBS_JOBID <cmd> <args>`" to spawn the process. When you use "`pbs_attach -j $PBS_JOBID <cmd> <args>`", `pbs_attach` sets the GPU-related environment variables in the environment of the process being spawned.

You must spawn the process via `pbs_attach` in order to have the environment variables set. If you spawn the process using another method and then use `pbs_attach` to attach it to the job, `pbs_attach` does not set the environment variables.

### 2.13.3 Options to `pbs_attach`

**-c <path to script>**

Windows only. Specified command is invoked using a new command shell. In order to spawn and attach built-in DOS commands such as `set` or `echo`, it is necessary to open the task using a `cmd` shell. The new command shell, `cmd.exe`, is attached as a task to the PBS job. The `pbs_attach` command spawns a program using a new command shell when attaching a batch script, or when invoked with the `-c` option.

**-j <job ID>**

The job ID to which the session ID is to be attached. If *job ID* is not specified, a best effort is made to determine the job to which to attach the session.

**-m <port number>**

The port at which to contact MoM. Default: value of `$PBS_MANAGER_SERVICE_PORT` from `pbs.conf`.

**-p <PID>**

Process ID whose session ID is to be attached to the job. Default: process ID of `pbs_attach`. Cannot be used with the `-P` or `-s` options or the `cmd` operand.

**-P**

Attach sessions of both `pbs_attach` and the parent of `pbs_attach` to job. When used with `-s` option, the sessions of the new `fork()`ed `pbs_attach` and its parent, which is `pbs_attach`, are attached to the job. Cannot be used with the `-p` or `-s` options or the `cmd` operand.

**-s**

Starts a new session and attaches it to the job; `pbs_attach` calls `fork()`, then the child `pbs_attach` first calls `setsid()` and then calls `tm_attach` to attach the new session to the job. The session ID of the new `pbs_attach` is attached to the job.

**--version**

The `pbs_attach` command returns its PBS version information and exits. This option can only be used alone.

### 2.13.4 Operands

**cmd**

Name of command whose process ID is to be associated with the job.

### 2.13.5 Exit Status

**0**

Success

**1**

Any error following successful command line processing. A message is printed to standard error.

If *cmd* is specified, `pbs_attach` waits for *cmd* to exit, then exits with the exit value of *cmd*.

If *cmd* is not specified, `pbs_attach` exits after attaching the session ID(s) to the job.

## 2.13.6 See Also

The PBS Professional Administrator's Guide, ["pbs\\_mom" on page 74](#), ["pbs\\_tmrsh" on page 126](#), ["TM Library", on page 93 of the PBS Professional Programmer's Guide](#)



## 2.14 pbs\_comm

Starts the PBS communication daemon

### 2.14.1 Synopsis

```
pbs_comm [-N] [-r <other routers>] [-t <number of threads>]
pbs_comm --version
```

### 2.14.2 Description

The PBS communication daemon, `pbs_comm`, handles communication between daemons, except for scheduler-server and server-server communication, which uses TCP. The server, scheduler(s), and MoMs are connected by one or more `pbs_comm` daemons.

See [“Communication” on page 47 in the PBS Professional Installation & Upgrade Guide](#).

Available on Linux only.

### 2.14.3 Options to pbs\_comm

**-N**

Runs the communication daemon in standalone mode.

**-r <other routers>**

List of other `pbs_comm` daemons to which this `pbs_comm` must connect. This is equivalent to the `pbs.conf` variable `PBS_COMM_ROUTERS`. The command line overrides the variable. Format:

`<hostname>[:<port number>][,<hostname>[:<port number>]]`

**-t <number of threads>**

Number of threads the `pbs_comm` daemon uses. This is equivalent to the `pbs.conf` variable `PBS_COMM_THREADS`. The command line overrides the variable. Format:

*Integer*

**--version**

Prints the PBS version information and exits. This option can only be used alone.

### 2.14.4 Configuration Parameters

#### PBS\_LEAF\_ROUTERS

Parameter in `/etc/pbs.conf`. Tells an endpoint where to find its communication daemon.

You can tell each endpoint which communication daemon it should talk to. Specifying the port is optional.

Format: `PBS_LEAF_ROUTERS=<hostname>[:<port number>][,<hostname>[:<port number>]]`

#### PBS\_COMM\_ROUTERS

Parameter in `/etc/pbs.conf`. Tells a `pbs_comm` where to find its fellow communication daemons.

When you add a communication daemon, you must tell it about the other `pbs_comms` in the complex. When you inform communication daemons about each other, you only tell one of each pair about the other. Do not tell both about each other. We recommend that an easy way to do this is to tell each new `pbs_comm` about each existing `pbs_comm`, and leave it at that.

---

Format: `PBS_COMM_ROUTERS=<hostname>[:<port number>][,<hostname>[:<port number>]]`

### PBS\_COMM\_THREADS

Parameter in `/etc/pbs.conf`. Tells `pbs_comm` how many threads to start.

By default, each `pbs_comm` process starts four threads. You can configure the number of threads that each `pbs_comm` uses. Usually, you want no more threads than the number of processors on the host.

Maximum allowed value: `100`

Format: *Integer*

Example:

```
PBS_COMM_THREADS=8
```

### PBS\_COMM\_LOG\_EVENTS

Parameter in `/etc/pbs.conf`. Tells `pbs_comm` which log mask to use.

By default, `pbs_comm` produces few log messages. You can choose more logging, usually for troubleshooting. See [“Logging and Errors” on page 55 in the PBS Professional Installation & Upgrade Guide](#) for logging details.

Format: *Integer*

Default: `511`

Example:

```
PBS_COMM_LOG_EVENTS=<log level>
```

### PBS\_LEAF\_NAME

Parameter in `/etc/pbs.conf`. Tells endpoint what name to use for network. The value does not include a port, since that is usually set by the daemon.

By default, the name of the endpoint's host is the hostname of the machine. You can set the name where an endpoint runs. This is useful when you have multiple networks configured, and you want PBS to use a particular network.

The server only queries for the canonicalized address of the MoM host, unless you let it know via the `Mom` attribute; if you have set `PBS_LEAF_NAME` in `/etc/pbs.conf` to something else, make sure you set the `Mom` attribute at vnode creation.

TPP internally resolves the name to a set of IP addresses, so you do not affect how `pbs_comm` works.

Format: *String*

Example:

```
PBS_LEAF_NAME=host1
```

### PBS\_START\_COMM

Parameter in `/etc/pbs.conf`. Tells PBS init script whether to start a `pbs_comm` on this host if one is installed. When set to `1`, `pbs_comm` is started.

Just as with the other PBS daemons, you can specify whether each host should start `pbs_comm`.

Format: *Boolean*

Default: `0`

Example:

```
PBS_START_COMM=1
```

## 2.14.5 Communication Daemon Logfiles

The `pbs_comm` daemon creates its log files under `$PBS_HOME/comm_logs`. This directory is automatically created by the PBS installer.

---

In a failover configuration, this directory is in the shared `PBS_HOME`, and is used by the `pbs_comm` daemons running on both the primary and secondary servers. This directory must never be shared across multiple `pbs_comm` daemons in any other case.

The log filename format is `yyyymmdd` (the same as for other PBS daemons).

The log record format is the same as used by other `pbs` daemons, with the addition of the thread number and the daemon name in the log record. The log record format is as follows:

`<date and time>;<event code>;<daemon name>(<thread number>);<object type>;<object name>;<message>`

Example:

```
03/25/2014 15:13:39;0d86;host1.example.com;TPP;host1.example.com(Thread 2);Connection from leaf
192.168.184.156:19331, tfd=81 down
```

## 2.14.6 Signal Handling by Communication Daemon

The `pbs_comm` daemon handles the following signals:

### HUP

Re-reads the value of `$PBS_COMM_LOG_EVENTS` from `pbs.conf`.

### TERM

The `pbs_comm` daemon exits.

## 2.15 pbs\_datservice

Start, stop, or check the status of PBS data service

### 2.15.1 Synopsis

*pbs\_datservice [start | stop | status]*

### 2.15.2 Description

The `pbs_datservice` command starts, stops or gets the status of the PBS data service.

#### 2.15.2.1 Permission

Root privilege is required to use this command.

### 2.15.3 Arguments

**start**

Starts the PBS data service.

**stop**

Stops the PBS data service.

Can be used only when the PBS server is not running.

**status**

Displays the status of the PBS data service, as follows:

- Data service running  
PBS Data Service running
- Data service not running  
PBS Data Service not running

### 2.15.4 Exit Status

**Zero**

Success

**Non-zero**

Failure

## 2.16 pbs\_ds\_password

Sets or changes data service user account or its password

### 2.16.1 Synopsis

```
pbs_ds_password [-C <username>] [-r] [-t <TLS certificate file>]
```

### 2.16.2 Description

You can use this command to change the user account or account password for the data service.

#### 2.16.2.1 Passwords

Blank passwords are not allowed.

If you type in a password, make sure it does not contain restricted characters. The `pbs_ds_password` command generates passwords containing the following characters:

```
0123456789abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ!@#$$%^&*()_+
```

When creating a password manually, do not use \ (backslash) or ' (backquote). This can prevent certain commands such as `pbs_server`, `pbs_ds_password`, and `printjob` from functioning properly, as they rely on connecting to the database. The format is also described in ["PBS Password" on page 361](#).

#### 2.16.2.2 Encrypting Password with New Certificate

You can encrypt the database (DB) password with a new certificate via the `-t <TLS certificate file>` option. For example:

```
pbs_ds_password -t /root/mycert.pem
```

When you use this option, PBS does the following:

1. Decrypts the DB password (`$PBS_HOME/server_priv/db_password`) using the existing TLS key
2. Copies the certificate provided to `$PBS_HOME/certs/cert.pem`. It also creates a backup of the old `cert.pem` as `cert.pem.backup`.
3. Encrypts the DB password with the new certificate
4. Saves the encrypted password in `$PBS_HOME/server_priv/db_password`

Only the `cert.pem` is copied, and not the corresponding `key.pem` or `pbs_ca.pem`.

#### 2.16.2.3 Permissions

On Linux, root privilege is required to use this command. On Windows, Admin privilege is required.

#### 2.16.2.4 Restrictions

Do not run this command if failover is configured. It is important not to inadvertently start two separate instances of the data service on two machines, thus potentially corrupting the database. If failover is configured, stop the secondary server, remove definitions for `PBS_PRIMARY` and `PBS_SECONDARY` from `pbs.conf` on the primary server host, start PBS, run `pbs_ds_password`, stop PBS, replace the definitions, and start PBS again.

### 2.16.3 Options to `pbs_ds_password`

**-C <username>**

Changes user account for data service to specified account. Specified user account must already exist.

On Linux-based systems, the specified user account must not be root.

On Windows, the specified user account must match the PBS service account (which can be any user account.)

This option cannot be used while the data service is running.

Can be used with the `-r` option to automatically generate a password for the new account.

**-r**

Generates a random password. The data service is updated with the new password.

Can be used with the `-C` option.

**-t <TLS certificate file>**

Decrypts password using old key then encrypts it using new key.

**(no options)**

Asks the user to enter a new password twice. Entries must match. Updates data service with new password.

### 2.16.4 Exit Status

**Zero**

Success

**Non-zero**

Failure

---

## 2.17 pbs\_hostn

Reports hostname and network address(es)

### 2.17.1 Synopsis

*pbs\_hostn* [ -v ] <hostname>

*pbs\_hostn* --version

### 2.17.2 Description

The *pbs\_hostn* command takes a hostname, and reports the results of both the *gethostbyname*(3) and *gethostbyaddr*(3) system calls. Both forward and reverse lookup of hostname and network addresses need to succeed in order for PBS to authenticate a host.

Running this command can assist in troubleshooting problems related to incorrect or non-standard network configuration, especially within clusters.

### 2.17.3 Options

-v

Turns on verbose mode.

--version

The *pbs\_hostn* command returns its PBS version information and exits. This option can only be used alone.

### 2.17.4 Operands

hostname

The *pbs\_hostn* command accepts a *hostname* operand either in short name form, or in fully qualified domain name (FQDN) form.

### 2.17.5 Standard Error

The *pbs\_hostn* command writes a diagnostic message to standard error for each error occurrence.

### 2.17.6 Exit Status

Zero

Upon successful processing of all the operands presented to the *pbs\_hostn* command.

Greater than zero

If the *pbs\_hostn* command fails to process any operand.

## 2.18 pbs\_idled

Runs PBS daemon that monitors the console and informs pbs\_mom of idle time

### 2.18.1 Linux Synopsis

```
pbs_idled [-D <display>] [-r <reconnect delay>] [-w <wait time>]  
pbs_idled --version
```

### 2.18.2 Windows Synopsis

```
pbs_idled [start | stop]  
pbs_idled --version
```

### 2.18.3 Linux Description

On Linux, the pbs\_idled program monitors an X windows display and communicates the idle time of the display back to PBS. If the mouse is moved or a key is touched, PBS is informed that the vnode is busy.

You should run this program from the system-wide Xsession file, in the background before the window manager is run. If this program is run outside of the Xsession, it needs to be able to make a connection to the X display. See the xhost or xauth man pages for a description of X security.

### 2.18.4 Windows Description

On Windows, pbs\_idled reads its polling interval from a file called idle\_poll\_time which is created by MoM. The service monitors keyboard, mouse, and console activity, and updates a file called idle\_touch when it finds user activity. The idle\_touch file is created by MoM.

### 2.18.5 Linux Options to pbs\_idled

**-D <display>**

The display to connect to and monitor

**-r <reconnect delay>**

Time to wait before we try to reconnect to the X display if the previous attempt was unsuccessful

**-w <wait time>**

Interval between times when the daemon checks for events or pointer movement

**--version**

The pbs\_idled command returns its PBS version information and exits. This option can only be used alone.

### 2.18.6 Windows Options to pbs\_idled

**start**

Starts the pbs\_idled process.



**stop**

Stops the `pbs_idled` process.

**--version**

The `pbs_idled` process returns its PBS version information and exits. This option can only be used alone.

## 2.18.7 See Also

The PBS Professional Administrator's Guide

`xhost(1)`, `xauth(1)`

## 2.19 pbs\_iff

Tests authentication with the server

### 2.19.1 Usage

```
pbs_iff [-t] <server host> <server port>
```

```
pbs_iff --version
```

### 2.19.2 Description

Called from the `pbs_connect()` IFL API to authenticate a connection with the PBS server. Designed to be called internally by PBS commands and components, to be used by our IFL layer to talk to the server.

If `pbs_iff` cannot authenticate, it returns an error message.

#### 2.19.2.1 Required Privilege

Can be run by any user.

It's a setuid root binary so it runs as the user who requests a connection to a server but it becomes root so that it can grab a privileged port.

### 2.19.3 Options to pbs\_iff

`-t`

Test mode; means test whether `pbs_iff` can authenticate with the server

`--version`

Reports version and exits; can only be used alone

### 2.19.4 Arguments to pbs\_iff

`daemon host`

Host where server is running

`daemon port`

Port on which server is listening; default is 15001

### 2.19.5 Exit Status

Zero

If `pbs_iff` is able to contact the server at the specified port

Non-zero

If `pbs_iff` is unable to contact the server at the specified port

---

## 2.20 pbs\_interactive

Windows. Register, unregister, or get the version of PBS\_INTERACTIVE service

### 2.20.1 Synopsis

*pbs\_interactive [R | U]*

*pbs\_interactive --version*

### 2.20.2 Description

The `pbs_interactive` command registers, unregisters, or gets the version of the Windows PBS\_INTERACTIVE service. The service must be registered manually; the installer does not register it.

On Windows, the PBS\_INTERACTIVE service itself monitors logging in and out by users, starts a `pbs_idled` process for each user logging in, and stops the `pbs_idled` process of each user logging out.

#### 2.20.2.1 Required Privilege

Admin privilege is required to use this command.

### 2.20.3 Arguments

R

Registers the PBS\_INTERACTIVE service.

U

Unregisters the PBS\_INTERACTIVE service.

--version

The `pbs_interactive` command returns its PBS version information and exits. This option can only be used alone.

## 2.21 pbs\_login

Caches encrypted user password for authentication

### 2.21.1 Usage

*pbs\_login*

*pbs\_login -m <PBS service account password>*

*echo <password> | pbs\_login -p*

### 2.21.2 Description

The `pbs_login` command encrypts the password and caches it locally where it can be used by daemons for authorization.

Job submitters must run this command at each submission host each time their password changes.

#### 2.21.2.1 Behavior on Windows

On Windows, the `win_postinstall` script calls `pbs_login` to store the PBS service account password so that the account user can be authenticated by daemons.

On Windows, when using this command non-interactively, for example in a script, a CR-LF may be appended to the password, causing authentication to fail. To avoid this:

```
echo | set /p <dummy name>=<password> | pbs_login -p
```

### 2.21.3 Required Privilege

Can be run by any user.

### 2.21.4 Options to pbs\_login

(no options)

Queries user for password.

**-m <PBS service account password>**

This option is intended to be used only by the PBS service account, which is the account that is used to execute `pbs_mom` via the Service Control Manager on Windows. This option is used during installation when invoked by the `win_postinstall` script, or by the administrator when the PBS service account password has changed. Stores PBS service account password in the `mom_priv` directory.

**-p**

Caches user password on client host. Intended to be run by job submitter at client host. Allows job submitter to be authenticated by daemons.

---

## 2.22 pbs\_mkdirs

For Windows. Create, or fix the permissions of, the directories and files used by PBS

### 2.22.1 Synopsis

*pbs\_mkdirs*

*pbs\_mkdirs [ mom ]*

### 2.22.2 Description

Runs on Windows only. If the directories and files used by PBS exist, the `pbs_mkdirs` command fixes their permissions. If the directories and/or files do not exist, the `pbs_mkdirs` command creates them, with the correct permissions. The `pbs_mkdirs` command always examines the following directories and files:

- `pbs.conf`
- `PBS_EXEC`
- `PBS_HOME/spool`
- `PBS_HOME/undelivered`
- `PBS_HOME/pbs_environment`

#### 2.22.2.1 Required Privilege

You must have Administrator privilege to run this command.

### 2.22.3 Options

`mom`

The `pbs_mkdirs` command examines the following additional items:

- `PBS_HOME/mom_priv`
- `PBS_HOME/mom_logs`

(no options)

The `pbs_mkdirs` command examines all of the files and directories specified for the `mom` option.

### 2.22.4 See Also

The PBS Professional Administrator's Guide, ["pbs\\_probe" on page 83](#)

## 2.23 pbs\_mom

Runs the PBS job monitoring and execution daemon

### 2.23.1 Synopsis

```
pbs_mom [-a <alarm timeout>] [-C <checkpoint directory>] [-c <config file>] [-d <MoM home directory>] [-L
<logfile>] [-M <MoM port>] [-N] [-n <nice value>] [-p|-r] [-R <inter-MoM communication port>] [-S <server
port>] [-s <options>]
```

```
pbs_mom --version
```

### 2.23.2 Description

The `pbs_mom` command starts the PBS job monitoring and execution daemon, called *MoM*.

The standard MoM starts jobs on the execution host, monitors and reports resource usage, enforces resource usage limits, and notifies the server when the job is finished. The MoM also runs any prologue scripts before the job runs, and runs any epilogue scripts after the job runs.

The MoM performs any communication with job tasks and with other MoMs. The MoM on the first vnode on which a job is running manages communication with the MoMs on the remaining vnodes on which the job runs.

The MoM manages one or more vnodes. PBS may treat a host as a set of virtual nodes, in which case one MoM manages all of the host's vnodes. See ["Configuring MoMs and Vnodes" on page 39 in the PBS Professional Administrator's Guide](#).

#### 2.23.2.1 Logging

The MoM's log file is in `PBS_HOME/mom_logs`. The MoM writes an error message in its log file when it encounters any error. If it cannot write to its log file, it writes to standard error. The MoM writes events to its log file. The MoM writes its PBS version and build information to the logfile whenever it starts up or the logfile is rolled to a new file.

#### 2.23.2.2 Required Permission

The executable for `pbs_mom` is in `PBS_EXEC/sbin`, and can be run only by root on Linux, and Admin on Windows.

##### 2.23.2.2.i HPE Systems Running Supported Versions of HPE MPI

A PBS job can run across multiple machines that run supported versions of HPE MPI.

PBS can run using HPE's MPI (MPT) over InfiniBand. See the PBS Professional Administrator's Guide.

#### 2.23.2.3 Effect on Jobs of Starting MoM

When MoM is started or restarted, her default behavior is to leave any running processes running, but to tell the PBS server to requeue the jobs she manages. MoM tracks the process ID of jobs across restarts.

In order to have all jobs killed and requeued, use the `-r` option when starting or restarting MoM.

In order to leave any running processes running, and not to requeue any jobs, use the `-p` option when starting or restarting MoM.

---

## 2.23.3 Options to pbs\_mom

### -a <alarm timeout>

Number of seconds before alarm timeout. Whenever a resource request is processed, an alarm is set for the given amount of time. If the request has not completed before *alarm timeout*, the OS generates an alarm signal and sends it to MoM.

Format: *Integer*

Default: *10 seconds*

### -C <checkpoint directory>

Specifies the path to the directory where MoM creates job-specific subdirectories used to hold each job's restart files. MoM passes this path to checkpoint and restart scripts. Overrides other checkpoint path specification methods. Any directory specified with the -C option must be owned, readable, writable, and executable by root only (*rwX,---,---*, or *0700*), to protect the security of the restart files. See the -d option to pbs\_mom and ["Specifying Checkpoint Path" on page 413 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *PBS\_HOME/checkpoint*

### -c <config file>

MoM will read this alternate default configuration file upon starting. If this is a relative file name it is relative to *PBS\_HOME/mom\_priv*. If the specified file cannot be opened, pbs\_mom will abort. See the -d option.

MoM's normal operation, when the -c option is not given, is to attempt to open the default configuration file *PBS\_HOME/mom\_priv/config*. If this file is not present, pbs\_mom will log the fact and continue.

### -d <MoM home directory>

Specifies the path of the directory to be used in place of *PBS\_HOME* by pbs\_mom. The default directory is given by *\$PBS\_HOME*.

Format: *String*

### -L <logfile>

Specifies an absolute path and filename for the log file. The default is a file named for the current date in *PBS\_HOME/mom\_logs/*. See the -d option.

Format: *String*.

### -M <MoM port>

Specifies the port number on which MoM will listen for server requests and instructions. Overrides *PBS\_MOM\_SERVICE\_PORT* setting in *pbs.conf* and environment variable.

Format: *Integer port number*.

Default: *15002*.

### -n <nice value>

Specifies the priority for the pbs\_mom daemon.

Format: *Integer*.

### -N

Specifies that when starting, MoM should not detach from the current session.

### -p

Specifies that when starting, MoM should allow any running jobs to continue running, and not have them queued. Cannot be used with the -r option. MoM is not the parent of these jobs.

**-r**

Specifies that when starting, MoM should requeue any rerunnable jobs and kill any non-rerunnable jobs that she was tracking, and mark the jobs as terminated. Cannot be used with the **-p** option. MoM is not the parent of these jobs.

It is not recommended to use the **-r** option after a reboot, because process IDs of new, legitimate tasks may match those MoM was previously tracking. If they match and MoM is started with the **-r** option, MoM will kill the new tasks.

**-R <inter-MoM communication port>**

Specifies the port number on which MoM will listen for pings, resource information requests, communication from other MoMs, etc. Overrides **PBS\_MANAGER\_SERVICE\_PORT** setting in **pbs.conf** and environment variable.

Format: *Integer port number*

Default: *15003*

**-S <server port>**

Specifies the port number on which **pbs\_mom** initially contacts the server.

Format: *Integer port number*

Default: *15001*

**-s <file options>**

Make sure that the vnode names in any Version 2 configuration file exactly match those in the output of **pbsnodes -av**.

This option lets you add, delete, and display Version 2 configuration files. Run this command at the host you want to change. The *file options* are used this way:

**-s insert <Version 2 filename> <input file>**

Reads *inputfile* and copies it to a Version 2 vnode configuration file with the filename *Version 2 filename*. For example, to create a Version 2 file named "Myhost\_V2":

```
pbs_mom -s insert <Myhost_V2> <myhost_v2_input>
```

If a configuration file with the specified *Version 2 filename* already exists, the operation fails, and **pbs\_mom** prints a diagnostic and exits with a nonzero status. Configuration files whose names begin with the prefix "**PBS**" are reserved. You cannot add a file whose name begins with "**PBS**"; **pbs\_mom** will print a diagnostic message and exit with a nonzero status.

**-s remove <Version 2 filename>**

Removes the configuration file named *Version 2 filename* if it exists. Example:

```
pbs_mom -s remove <Version 2 filename>
```

If the file does not exist or if you try to remove a file with the reserved "**PBS**" prefix, the operation fails, and **pbs\_mom** prints a diagnostic and exits with a nonzero status.

**-s show <Version 2 filename>**

Prints the contents of the named file to standard output. Example:

```
pbs_mom -s show <Version 2 filename>
```

If *Version 2 filename* does not exist, the operation fails and **pbs\_mom** writes a diagnostic and exits with a nonzero status.

**-s list**

MoM lists the PBS-prefixed and site-defined configuration files in the order in which they are executed. Example:

```
pbs_mom -s list
```

**WINDOWS:**



---

Under Windows, use the `-N` option so that `pbs_mom` will start up as a standalone program. For example:

```
pbs_mom -N -s insert <Version 2 filename> <input file>
```

or

```
pbs_mom -N -s list
```

`--version`

The `pbs_mom` command returns its PBS version information and exits. This option can only be used alone.

## 2.23.4 Files and Directories

`$PBS_HOME/mom_priv`

Default directory for default configuration files.

`$PBS_HOME/mom_priv/config`

MoM's default configuration file.

`$PBS_HOME/mom_logs`

Default directory for log files written by MoM.

`$PBS_HOME/mom_priv/prologue`

File containing administrative script to be run before job execution.

`$PBS_HOME/mom_priv/epilogue`

File containing administrative script to be run after job execution.

## 2.23.5 Signal Handling

`pbs_mom` handles the following signals:

**SIGHUP**

The `pbs_mom` daemon rereads its configuration files, closes and reopens the log file, and reinitializes resource structures.

**SIGALRM**

MoM writes a log file entry. See the `-a <alarm timeout>` option.

**SIGINT**

The `pbs_mom` daemon exits, leaving all running jobs still running. See the `-p` option.

**SIGKILL**

This signal is not caught. The `pbs_mom` daemon exits immediately.

**SIGTERM, SIGXCPU, SIGXFSZ, SIGCPULIM, SIGSHUTDN**

The `pbs_mom` daemon terminates all running children and exits.

**SIGPIPE, SIGUSR1, SIGUSR2, SIGINFO**

These are ignored.

All other signals have their default behavior installed.

## 2.23.6 Exit Status

### Zero

Upon success

### Greater than zero

- If the `pbs_mom` daemon fails to start
- If the `-s insert` option is used with an existing *Version 2 filename*
- If the administrator attempts to add a script whose name begins with "*PBS*"
- If the administrator attempts to use the `-s remove` option on a nonexistent configuration file, or on a configuration file whose name begins with "*PBS*"
- If the administrator attempts to use the `-s show` option on a nonexistent script

## 2.23.7 See Also

The PBS Professional Administrator's Guide

## 2.24 pbs\_mpihp

Runs an MPI application in a PBS job with HP MPI

### 2.24.1 Synopsis

```
pbs_mpihp [-h <hostname>] [-np <number>] [<other HP mpirun options>] <program> [<args>]
```

```
pbs_mpihp [<HP mpirun options>] -f <appfile> [-- [<extra args>]]
```

```
pbs_mpihp --version
```

### 2.24.2 Description

The PBS command `pbs_mpihp` replaces the standard `mpirun` command in a PBS HP MPI job, for executing programs. `pbs_mpihp` is a front end to the HP MPI version of `mpirun`.

When `pbs_mpihp` is invoked from a PBS job, it processes the command line arguments, then calls standard HP `mpirun` to actually start the MPI ranks. The ranks created are mapped onto CPUs on the vnodes allocated to the PBS job. The environment variable `MPI_REMSH` is set to `$PBS_EXEC/bin/pbs_tmrsh`. This causes the processes that are created to become part of the PBS job.

The path to standard HP `mpirun` is found by checking to see if a link exists with the name `PBS_EXEC/etc/pbs_mpihp`. If this link exists, it points to standard HP `mpirun`. If it does not exist, a call to `mpirun -version` is made to determine whether it is HP `mpirun`. If so, the call is made to "mpirun" without an absolute path. If HP `mpirun` cannot be found, an error is output, all temp files are cleaned up and the script exits with value 127.

If `pbs_mpihp` is invoked from outside a PBS job, it passes all of its arguments directly to standard HP `mpirun` without further processing.

#### 2.24.2.1 Configuration

When HP MPI is wrapped with `pbs_mpihp`, "rsh" is the default used to start the mpids. If you wish to use "ssh" or something else, be sure to set the following in `$PBS_HOME/pbs_environment`:

```
PBS_RSHCOMMAND=ssh
```

or put the following in the job script:

```
export PBS_RSHCOMMAND=<rsh_cmd>
```

#### 2.24.2.2 Usage

Usage is the same as for HP `mpirun`.

`pbs_mpihp <program>` allows one executable to be specified.

`pbs_mpihp -f <appfile>` uses an *appfile* to list multiple executables. The format is described in the HP `mpirun` man page. If this form is used from inside a PBS job, the file is read to determine what executables are to be run and how many processes are started for each.

Executing `pbs_mpihp` with the `-client` option is not supported under PBS.

### 2.24.3 Options to pbs\_mpihp

All options except the following are passed directly to HP `mpirun` with no modification.

-client

Not supported.

-f <appfile>

The specified *appfile* is read by `pbs_mpihp`.

-h <hostname>

Ignored by `pbs_mpihp`.

-l <username>

Ignored by `pbs_mpihp`.

-np <number>

Specifies the *number* of processes to run on the PBS vnodes.

--version

The `pbs_mpihp` command returns its PBS version information and exits. This option can only be used alone.

## 2.24.4 Exit Values

127

If HP `mpirun` cannot be found

## 2.24.5 See Also

The PBS Professional Administrator's Guide

`mpirun(1)`

---

## 2.25 pbs\_mpirun

**Deprecated.** Runs MPI programs under PBS with MPICH

### 2.25.1 Synopsis

*pbs\_mpirun [<mpirun options>]*

*pbs\_mpirun --version*

### 2.25.2 Description

The PBS command `pbs_mpirun` replaces the standard `mpirun` command in a PBS MPICH job using P4.

On Windows, this command cannot be used to start job processes or track a job's resource usage.

#### 2.25.2.1 Prerequisite

The PATH on remote machines must contain `PBS_EXEC/bin`.

#### 2.25.2.2 Usage

Usage is the same as for `mpirun`, except for the `-machinefile` option. All other options are passed directly to `mpirun`.

### 2.25.3 Options to pbs\_mpirun

#### <mpirun options>

The options to `pbs_mpirun` are the same as for `mpirun`, except for the `-machinefile` option. This is generated by `pbs_mpirun`. The user should not attempt to specify `-machinefile`.

The value for `-machinefile` is a temporary file created from `PBS_NODEFILE` in the format:

hostname-1[:number of processors]

hostname-2[:number of processors]

hostname-n[:number of processors]

where if the number of processors is not specified, it is `1`. An attempt by the user to specify the `-machinefile` option will result in a warning saying "Warning, `-machinefile` value replaced by PBS".

The default value for the `-np` option is the number of entries in `PBS_NODEFILE`.

#### --version

The `pbs_mpirun` command returns its PBS version information and exits. This option can only be used alone.

### 2.25.4 Environment Variables

`pbs_mpirun` modifies `P4_RSHCOMMAND` and `PBS_RSHCOMMAND`. Users should not edit these.

`pbs_mpirun` copies the value of `P4_RSHCOMMAND` into `PBS_RSHCOMMAND`.

## 2.25.5 See Also

The PBS Professional Administrator's Guide, `mpirun(1)`

---

## 2.26 pbs\_probe

**Deprecated.** Reports PBS diagnostic information and fixes permission errors

### 2.26.1 Synopsis

*pbs\_probe* [ -f | -v ]

*pbs\_probe* --version

### 2.26.2 Description

The `pbs_probe` command reports post-installation information useful for PBS diagnostics, and fixes permission errors.

#### 2.26.2.1 Information Sources

- Information that is supplied on the command line
- The file `/etc/pbs.conf`
- The file `/etc/init.d/pbs`
- The values of any of the following environment variables; these may be set in the environment in which `pbs_probe` is run: `PBS_CONF_FILE`, `PBS_HOME`, `PBS_EXEC`, `PBS_START_SERVER`, `PBS_START_MOM`, and `PBS_START_SCHED`

#### 2.26.2.2 Required Privilege

In order to execute `pbs_probe`, you must have PBS Operator or Manager privilege.

### 2.26.3 Options to pbs\_probe

(no options)

Run in "report" mode. In this mode `pbs_probe` reports any permission errors detected in PBS infrastructure files. The command categorizes the errors and writes a list of them by category. Empty categories are not written.

-f

Run in "fix" mode. In this mode `pbs_probe` examines each of the relevant infrastructure files and, where possible, fixes any permission errors that it detects, and prints a message saying what got changed. If it is unable to fix a problem, it prints a message saying what was detected.

-v

Run in "verbose" mode. In this mode `pbs_probe` writes a complete list of the infrastructure files that it checked.

--version

The `pbs_probe` command returns its PBS version information and exits. This option can only be used alone.

### 2.26.4 Standard Error

The `pbs_probe` command writes a diagnostic message to standard error for each error occurrence.

## 2.26.5 Exit Status

Exit code does not reflect results of probe; it reflects whether or not the program ran.

Zero

When run correctly, whether or not `pbs_probe` finds any problems or errors

Non-negative

When run incorrectly

## 2.26.6 See Also

The PBS Professional Administrator's Guide



## 2.27 pbs\_python

Python interpreter for debugging a hook script from the command line

### 2.27.1 Synopsis

```
pbs_python --hook [-e <log event mask>] [-i <event input file>] [-L <log dir>] [-l <log file>] [-o <hook execution record>] [-r <resourcedef file>] [-s <site data file>] [<Python script>]
```

```
pbs_python <standard Python options>
```

```
pbs_python --version
```

### 2.27.2 Description

The PBS Python interpreter, `pbs_python`, is a wrapper for Python.

You can use the `pbs_python` wrapper that is shipped with PBS to debug hooks. Either:

- Use the `--hook` option to `pbs_python` to run `pbs_python` as a wrapper to Python, employing the `pbs_python` options. With the `--hook` option, you cannot use the standard Python options. The rest of this section covers how to use `pbs_python` with the `--hook` option.
- Do not use the `--hook` option, so `pbs_python` runs the Python interpreter, with the standard Python options, and without access to the `pbs_python` options.

#### 2.27.2.1 Debugging Hooks

You can get each hook to write out debugging files, and then modify the files and use them as debugging input to `pbs_python`. Alternatively, you can write the files yourself.

Debugging files can contain information about the event, about the site, and about what the hook changed. You can use these as inputs to a hook when debugging.

For a complete description of using `pbs_python` with debugging files, see ["Debugging Hooks" on page 185 in the PBS Professional Hooks Guide](#).

### 2.27.3 Options to pbs\_python

#### `--hook`

This option is a switch. When you use this option, you can use the PBS Python module (via `"import pbs"`), and the other options described here are available. When you use this option, you cannot use the standard Python options. This option is useful for debugging.

When you do not use this option, you cannot use the other options listed here, but you can use the standard Python options.

#### `-e <log event mask>`

Sets the mask that determines which event types are logged by `pbs_python`. To see only debug messages, set the value to `0xd80`. To see all messages, set the value to `0xffff`. The `pbs_python` interpreter uses the same set of mask values that are used for the `$logevent <mask>` entry in the `pbs_mom` configuration file. See [section 2.23, "pbs\\_mom", on page 74](#). Available only when `--hook` option is used.

#### `-i <event input file>`

Text file containing data to populate `pbs.event()` objects. Each line specifies an attribute value or a resource value. Syntax of each input line is one of the following:

```
<object name>.<attribute name>=<attribute value>
<object name>.<resource list>[<resource name>]=<resource value>
```

Where

<object name> is a PBS object name which can refer to its sub-objects. Examples: `"pbs.event()", "pbs.event().job", "pbs.event().vnode_list["<vnode name>"]"`.

Example input file:

```
pbs.event().hook_name=proto
pbs.event().hook_type=site
pbs.event().type=queuejob
pbs.event().requestor=user1
pbs.event().requestor_host=host1
pbs.event().alarm=40
pbs.event().job.id=72
pbs.event().job.Job_Name=job1
pbs.event().job.Resource_List[ncpus]=5
pbs.event().job.Resource_List[mem]=6mb
pbs.event().vnode_list["host1"].resources_available["ncpus"] = 5
pbs.event().vnode_list["host1"].resources_available["mem"] = 300gb
```

Available only when `--hook` option is used.

#### **-L <log dir>**

Directory holding the log file where `pbs.logmsg()` and `pbs.logjobmsg()` write their output. Default is current working directory where `pbs_python` is executed. Available only when `--hook` option is used.

#### **-l <log file>**

Log file where `pbs.logmsg()` and `pbs.logjobmsg()` write their output. Default file name is current date in `yyyymmdd` format. Available only when `--hook` option is used.

#### **-o <hook execution record>**

The hook execution record contains the changes made after executing the hook script, such as the attributes and resources set in any `pbs.event()` jobs and reservations, whether an action was accepted or rejected, and any `pbs.reject()` messages.

Example hook execution record:

```
pbs.event().job.Job_Name=job2
pbs.event().job.Resource_List[file]=60gb
pbs.event().job.Resource_List[ncpus]=5
pbs.event().job.Resource_List[mem]=20gb
pbs.event().job.Account_Name=account2
pbs.event().reject=True
pbs.event().reject_msg=No way!
```

Without this option, output goes to `stdout`. Available only when `--hook` option is used.

#### **-r <resourcedef file>**

File/path name containing a resource definition specifying a custom resource whose Python type is `pbs.resource`. Format:

```
<resource name> type=<typename> [flag=<value>]
```

Available only when `--hook` option is used.

---

**-s <site data file>**

The site data file can contain any relevant information about the server, queues, vnodes, and jobs at the server. This file can be written by a hook or by the administrator.

When the hook writes it, this file contains the values that populate the server, queues, vnodes, reservations, and jobs, with all attributes and resources for which there are values.

The site data file is named *hook\_<event type>\_<hook name>\_<random integer>.data*. It can be passed to `pbs_python` using the `-s <site data file>` option.

Available only when `--hook` option is used.

**--version**

The `pbs_python` command prints its version information and exits. This option can only be used alone.

## 2.27.4 Arguments

**<Python script>**

The hook script to execute. We recommend importing the PBS Python module at the start of the script:

```
import pbs
```

If you do not specify *<Python script>*, you can perform interactive debugging. If you type the following:

```
% pbs_python --hook -i hook.input
```

The interpreter displays a prompt:

```
>>
```

You can type your Python lines at the prompt:

```
>>import pbs
>> e=pbs.event().job
>> print e.id
<job ID>
...
```

## 2.28 pbs\_ralter

Modifies an existing reservation

### 2.28.1 Summary

Alter an existing advance, standing, or job-specific reservation.

### 2.28.2 Synopsis

```
pbs_ralter [-D <duration>] [-E <end time>] [-G <auth group list>] [-I <block time>] [-l select=<select spec>] [-m <mail points>] [-M <mail list>] [-N <reservation name>] [-R <start time>] [-U <auth user list>] <reservation ID>
```

```
pbs_ralter -Wforce [-D <duration>] [-E <end time>] [-R <start time>] <reservation ID>
```

```
pbs_ralter -Wdelete_idle_time=<value>
```

```
pbs_ralter --version
```

### 2.28.3 Description

You can use the `pbs_ralter` command to alter an existing reservation, whether it is an individual job-specific, advance, or maintenance reservation, or the next or current occurrence of a standing reservation. You can change the start time, end time, duration, events that generate mail, mail recipient list, authorized groups, authorized users, select specification, and reservation name.

The PBS Administrator can use the `-Wforce` option to this command to change the start time, end time, or duration of a reservation; this option overrides the scheduler's actions.

After the change is requested, the change is either confirmed or denied. On denial of the change, the reservation is not deleted and is left as is, and the following message appears in the server's log:

```
Unable to alter reservation <reservation ID>
```

When a reservation is confirmed, the following message appears in the server's log:

```
Reservation alter successful for <reservation ID>
```

To find out whether or not the change was allowed:

- Use the `pbs_rstat` command to see whether you altered reservation attribute(s)
- Use the interactive option to check for confirmation after the blocking time has run out
- Check the server log for confirmation or denial messages

Before the change is confirmed or denied, the change is unconfirmed, and the reservation state is *AL*.

Once a reservation change is confirmed, the reservation state is *CO* or *RN*.

If the reservation has not started and it cannot be confirmed on the same vnodes, PBS searches for another set of vnodes.

If the reservation is altered, PBS logs a [Y](#) accounting record. See ["Types of Accounting Log Records" on page 552 in the PBS Professional Administrator's Guide](#).

#### 2.28.3.1 Caveats and Restrictions

You cannot change the start time of a reservation if jobs are running in it.

If you change the end time of a reservation so that it ends before a job running in the reservation finishes, the job is killed when the reservation ends.

If you change the select specification, the vnodes where jobs are running remain the same, but all other vnodes may change.

Do not attempt to alter a maintenance reservation.

Altering a reservation may change how top jobs are able to run, because altering a reservation has the same privilege as submitting a reservation.

### 2.28.3.2 Required Privilege

Without the `-wforce` option, this command can be used by the reservation owner or the PBS Administrator.

With the `-wforce` option, this command can be used only by the PBS Administrator.

## 2.28.4 Options to `pbs_ralter`

### -D <duration>

Specifies reservation's new duration. This option can be used even when the reservation is running and has jobs that are submitted to and/or are running in the reservation.

Can be specified with start and/or end time. PBS calculates anything not specified. When specified without start or end time, PBS keeps previous start time.

If you change the duration to less than the time the reservation has already run, PBS deletes the reservation.

Format: *Duration*, as *seconds* or *hh:mm:ss*

### -E <end time>

Specifies reservation's new end time. This option can be used even when the reservation is running and has jobs that are submitted to and/or are running in the reservation.

Format: *Datetime*

### -G <auth group list>

Comma-separated list of names of groups who can or cannot submit jobs to this reservation. Sets reservation's `Authorized_Groups` attribute to *auth group list*.

This list becomes the `acl_groups` list for the reservation's queue.

More specific entries should be listed before more general, because the list is read left-to-right, and the first match determines access.

If both the `Authorized_Users` and `Authorized_Groups` reservation attributes are set, a user must belong to both in order to be able to submit jobs to this reservation.

Group names are interpreted in the context of the server host, not the context of the host from which the job is submitted.

See the `Authorized_Groups` reservation attribute in [section 6.8, "Reservation Attributes", on page 308](#).

Syntax:

`[+|-]<group name>[+|-]<group name> ...]`

Default: no default; group names are unchanged

### -I <block time>

(Capital I) Specifies interactive mode. The `pbs_ralter` command will block, up to *block time* seconds, while waiting for the reservation's change request to be confirmed or denied.

The value for *block time* must be positive. The `pbs_ralter` command returns either the status "`CONFIRMED`" or the status "`DENIED`".

Format: *Integer*

Default: *Not interactive*

### **-l select=<select spec>**

(Lowercase L) Specifies new select specification for reservation. New specification can shrink the reservation using a subset of the same chunks requested by the original reservation, or can grow the reservation by specifying more chunks.

If jobs are running in the reservation:

- You cannot release chunks where reservation jobs are running
- Vnodes where jobs are running cannot change, but everything else can.

If no jobs are running, the select specification can be changed completely.

When requesting chunks, make sure each chunk request specifies chunks of a single type.

### **-m <mail points>**

Specifies the set of events that cause mail to be sent to the list of users specified in the **-M <mail list>** option.

Format: String

Syntax: Either of:

- Any combination of "a", "b", "c" or "e"
- The single character "n"

**Table 2-4: Suboptions to -m Option**

| Character | Meaning  |
|-----------|--|
| a         | Notify if reservation is terminated for any reason     |
| b         | Notify when the reservation period begins              |
| c         | Notify when the reservation is confirmed               |
| e         | Notify when the reservation period ends                |
| n         | Send no mail. Cannot be used with any of a, b, c or e. |

Default: No default; if not specified, mail events are unchanged.

### **-M <mail list>**

The list of users to whom mail is sent whenever the reservation transitions to one of the states specified in the **-m <mail points>** option.

Format: <username>[@<hostname>][,<username>[@<hostname>]...]

Default: No default; if not specified, user list is unchanged.

### **-N <reservation name>**

Specifies a name for the reservation.

Format: String up to 15 characters in length. It must consist of printable, non-white space characters with the first character alphabetic.

Default: No default; if not specified, reservation name is unchanged.

**-R <start time>**

Specifies reservation's new start time. This option can be used either when the reservation is not running or there are no jobs are submitted to the reservation. You cannot use this option when a reservation is not empty and has started running.

The specifications for providing the time are the same as for `pbs_rsub`:

If the day, `DD`, is not specified, it defaults to today if the time `hhmm` is in the future. Otherwise, the day is set to tomorrow. For example, if you alter a reservation with the specification `-R 1110 at 11:15 a.m.`, it is interpreted as being for 11:10 a.m. tomorrow. If the month portion, `MM`, is not specified, it defaults to the current month, provided that the specified day `DD`, is in the future. Otherwise, the month is set to next month. Similar rules apply to the two other optional, left-side components.

Format: *Datetime*

**-U <auth user list>**

Comma-separated list of users who are and are not allowed to submit jobs to this reservation. Sets reservation's `Authorized_Users` attribute to *auth user list*.

This list becomes the `acl_users` attribute for the reservation's queue.

More specific entries should be listed before more general, because the list is read left-to-right, and the first match determines access. The reservation creator's username is automatically added to this list, whether or not the reservation creator specifies this list.

If both the `Authorized_Users` and `Authorized_Groups` reservation attributes are set, a user must belong to both in order to be able to submit jobs to this reservation.

See the `Authorized_Users` reservation attribute in [section 6.8, "Reservation Attributes", on page 308](#).

Syntax:

```
[+|-]<username>[@<hostname>][.[+|-]<username>[@<hostname>]...]
```

Default: no default; user list is unchanged

**-W<extended options>**

This allows you to define other attributes for the reservation or perform other actions.

**delete\_idle\_time=<allowed idle time>**

Sets the reservation's `delete_idle_time` attribute to *allowed idle time*. Deletes the reservation after the specified amount of idle time. Applies to each instance of a standing reservation.

If the reservation is running and empty, the existing idle timer is restarted with the new value. If the reservation is not empty, the idle timer uses the new value the next time it starts.

The default value for the `delete_idle_time` attribute for an ASAP reservation is 10 minutes.

This option cannot be used when changing any other reservation attributes.

Format for *allowed idle time* is a duration.

To unset the `delete_idle_time` attribute, set it to an empty string:

```
pbs_ralter -Wdelete_idle_time=""
```

**force**

Enforces changes made to the reservation start time, end time, or duration, regardless of the actions of the scheduler. Can be used only by the PBS Administrator. Note that with this option you can force PBS to oversubscribe resources, in which case you (the administrator) may need to manage them yourself. Cannot be used to change the start time of a reservation in which jobs are running.

**--version**

The `pbs_ralter` command returns its PBS version information and exits. This option can only be used alone.

## 2.28.5 Operands

The `pbs_ralter` command takes a reservation ID.

For an advance or job-specific reservation this has the form:

*R*<sequence number>[.<server name>][@<remote server>]

For a standing reservation this has the form:

*S*<sequence number>[.<server name>][@<remote server>]

For a maintenance reservation this has the form:

*M*<sequence number>[.<server name>][@<remote server>]

@<remote server> specifies a reservation at a server other than the default server.



---

## 2.29 pbs\_rdel

Deletes a PBS reservation

### 2.29.1 Synopsis

```
pbs_rdel <reservation ID>[,<reservation ID>...]
```

```
pbs_rdel --version
```

### 2.29.2 Description

The `pbs_rdel` command deletes reservations in the order specified.

This command deletes the specified reservations, whether or not they are running, all jobs in the reservations, and the reservation queues.

You can delete an entire standing reservation, but not just one instance of a standing reservation.

### 2.29.3 Required Privilege

A reservation may be deleted by its owner, a PBS Operator, or a PBS Manager.

### 2.29.4 Options

`--version`

The `pbs_rdel` command returns its PBS version information and exits. This option can only be used alone.

### 2.29.5 Operands

The `pbs_rdel` command accepts one or more *reservation ID* operands.

For an advance or job-specific reservation this has the form:

```
R<sequence number>[.<server name>][@<remote server>]
```

For a standing reservation this has the form:

```
S<sequence number>[.<server name>][@<remote server>]
```

For a maintenance reservation this has the form:

```
M<sequence number>[.<server name>][@<remote server>]
```

@<remote server> specifies a reservation at a server other than the default server.

### 2.29.6 Exit Status

Zero

Upon success

Greater than zero

Upon failure to process any operand

## 2.29.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["pbs\\_rsub" on page 99](#), ["pbs\\_rstat" on page 97](#), ["Reservation Attributes" on page 308](#)

## 2.30 pbs\_release\_nodes

Releases sister chunks and/or vnodes assigned to a PBS job

### 2.30.1 Synopsis

```
pbs_release_nodes [-j <job ID>] [-k (<number of chunks to keep> | <selection of chunks to keep>)]
```

```
pbs_release_nodes [-j <job ID>] -a
```

```
pbs_release_nodes [-j <job ID>] <vnode name> [<vnode name> [<vnode name>] ...]
```

```
pbs_release_nodes --version
```

### 2.30.2 Description

You can use the `pbs_release_nodes` command to release no-longer-needed vnodes, or sister chunks, or chunks assigned to a running job, before the job would normally release them. These chunks are then available for use by other jobs. This command can be run at the command line, or called inside a job script, where it can use the value of the `PBS_JOBID` environment variable.

- To use the value of the `PBS_JOBID` environment variable, do not specify a job ID.
- To release all job chunks and vnodes that are not on the primary execution host:  
`pbs_release_nodes -j <job ID> -a`
- To specify a list of sister chunks to be kept, releasing all others that are not on the primary execution host:  
`pbs_release_nodes -j <job ID> -k <selection of chunks to keep>`
- To specify the number of chunks to keep, releasing all others that are not the primary execution chunk. You can use this to release chunks on the primary execution host:  
`pbs_release_nodes -j <job ID> -k <number of chunks to keep>`
- To specify the vnodes to release (this does not release vnodes on the primary execution host):  
`pbs_release_nodes -j <job ID> <vnode name> [<vnode name> [<vnode name>] ...]`

Can be used on jobs and subjobs, but not on job arrays or ranges of subjobs.

To see the chunks assigned to a job, look at the job's `exec_vnode` attribute.

#### 2.30.2.1 Caveats and Restrictions

- The job must be running (in the *R* state).
- If you try to release some but not all of a host, the job's `exec_vnode` attribute shows the new, smaller list of chunks, but the `pbsnodes` command will show that the host is still allocated to the job. PBS cannot run another job using those chunks.
- If you specify release of a chunk in which a job process is running, that process is terminated when the chunk is released.

#### 2.30.2.2 Required Privilege

This command can be run by the job owner, the PBS Manager, Operator, and Administrator, as well as root on Linux and Admin on Windows.

### 2.30.3 Options to `pbs_release_nodes`

**-a**

Releases all job chunks and vnodes not on the primary execution host. Cannot be used with **-k** option.

**-j <job ID>**

Specifies the job ID for the job or subjob whose chunks or vnodes are to be released.

**-k <keep number> | <keep selection>**

- Use *keep number* to specify how many sister chunks to keep, starting with the second in the job's `exec_vnode` attribute, and working toward the last. The first chunk is always kept. With the **-k keep number** option, you can release any chunks that are not the primary execution chunk. You cannot release the primary execution chunk on the primary execution host. The number that ends up being kept is  $k+1$ .
- Use *keep selection* to specify which sister chunks to keep. The *keep selection* is a select statement beginning with "select=" specifying which chunks to keep. With the **-k keep selection** option, you cannot release chunks on the primary execution host.

For example, to release all sister chunks except the primary chunk and 8 more:

```
pbs_release_nodes -k 8
```

To release all sister chunks except for the primary chunk and 4 of the ones with "bigmem":

```
pbs_release_nodes -k select=4:bigmem=true
```

Cannot be used with **-a** option.

**(no options)**

With no options, `pbs_release_nodes` uses the value of the `PBS_JOBID` environment variable as the job ID of the job whose chunks are to be released.

**--version**

The `pbs_release_nodes` command returns its PBS version information and exits. This option can only be used alone.

### 2.30.4 Operands for `pbs_release_nodes`

The `pbs_release_nodes` command can take as an operand a list of vnodes. Format:

```
<vnode name> [<vnode name> [<vnode name>] ...]
```

Cannot be used with the **-a** option.

## 2.31 pbs\_rstat

Shows status of PBS reservations

### 2.31.1 Synopsis

```
pbs_rstat [-B] [-f|-F] [-S] [<reservation ID>...]
```

```
pbs_rstat --version
```

### 2.31.2 Description

The `pbs_rstat` command shows the status of all reservations at the PBS server. Denied reservations are not displayed.

#### 2.31.2.1 Required Privilege

This command can be run by a user with any level of PBS privilege. For full output, users without manager or operator privilege cannot print custom resources which were created to be invisible to users.

### 2.31.3 Output

The `pbs_rstat` command displays output in any of brief, short, or full formats.

See [section 6.8, “Reservation Attributes”, on page 308](#) and [section 8.6, “Reservation States”, on page 371](#).

### 2.31.4 Options to pbs\_rstat

**-B**

Brief output. Displays each reservation identifier only.

**-f, -F**

Full output. Displays all reservation attributes that are not set to the default value. Users without manager or operator privilege cannot print custom resources which were created to be invisible to users.

**-S**

Short output. Displays a table showing the name, queue, owner, state, start time, duration, and end time of each reservation.

**--version**

The `pbs_rstat` command returns its PBS version information and exits. This option can only be used alone.

**(no options)**

Short output. Same behavior as `-S` option.

### 2.31.5 Operands

The `pbs_rstat` command accepts one or more *reservation ID* operands.

Format for an advance or job-specific reservation:

```
R<sequence number>[.<server name>][@<remote server>]
```

Format for a standing reservation:

*S*<sequence number>[.<server name>][@<remote server>]

Format for a maintenance reservation:

*M*<sequence number>[.<server name>][@<remote server>]

@<remote server> specifies a reservation at a server other than the default server.

## 2.31.6 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["Reservation Attributes" on page 308](#)

## 2.32 pbs\_rsub

Creates a PBS reservation

### 2.32.1 Synopsis

**For advance and standing reservations:**

```
pbs_rsub [-D <duration>] [-E <end time>] [-g <group list>] [-G <auth group list>] [-H <auth host list>] [-I <block time>] [-l <placement>] [-l <resource request>] [-m <mail events>] [-M <mail list>] [-N <reservation name>] [-q <destination>] [-r <recurrence rule>] [-R <start time>] [-u <user list>] [-U <auth user list>] [-W <attribute value list>]
```

**For job-specific now reservations:**

```
pbs_rsub [-I <block time>] [-m <mail events>] [-M <mail list>] --job <job ID>
```

**For maintenance reservations:**

```
pbs_rsub [-D <duration>] [-E <end time>] [-g <group list>] [-G <auth group list>] [-H <auth host list>] [-m <mail events>] [-M <mail list>] [-N <reservation name>] [-q <destination>] [-R <start time>] [-u <user list>] [-U <auth user list>] --hosts <host list>
```

**For version information:**

```
pbs_rsub --version
```

### 2.32.2 Description

The `pbs_rsub` command is used to create advance, standing, job-specific now, job-specific ASAP, or maintenance reservations. For creating job-specific start reservations, see ["qsub" on page 221](#).

- An advance reservation reserves specific resources for the requested time period.
- A standing reservation reserves specific resources for recurring time periods.
- A job-specific now reservation reserves the resources being used by a specific job in case the job fails and needs to be re-submitted, allowing it to run again without having to wait to be scheduled. The reservation is created and starts running when a queued job starts running, or immediately when you use `pbs_rsub --job <job ID>` on a running job.
- A job-specific ASAP reservation is created from a queued job via `pbs_rsub -Wqmove=<job ID>`. The reservation runs as soon as possible, and the job is moved into the reservation. The reservation is created using the same resources as the job requested.
- A job-specific start reservation is created immediately using a running job's resources, and the job is moved into the reservation. You create job-specific start reservations using `qsub -Wcreate_resv_from_job=true` on a running job or when you `qalter` a job to set the job's `create_resv_from_job` attribute to `True`. See the `qsub` command.
- A maintenance reservation reserves the specified hosts for the specified time regardless of other circumstances.

Advance, standing, and job-specific reservations are "job reservations", to distinguish them from maintenance reservations. When a reservation is created, it has an associated queue.

To get information about a reservation, use the `pbs_rstat` command.

To delete a reservation, use the `pbs_rdel` command. Do not use the `qdel` command.

The behavior of the `pbs_rsub` command may be affected by any site hooks. Site hooks can modify the reservation's attributes.

### 2.32.2.1 Job Reservations

After an advance or standing reservation is requested, it is either confirmed or denied. A job-specific now reservation is created when the job is started and confirmed immediately. A job-specific ASAP reservation is scheduled as soon as possible. Once the reservation has been confirmed, authorized users submit jobs to the reservation's queue via `qsub` and `qmove`.

A confirmed job reservation will accept jobs at any time. The jobs in its queue can run only during the reservation period. Jobs in a single advance reservation or job-specific reservation can run only during the reservation's time slot, and jobs in a standing reservation can run only during the time slots of occurrences of the standing reservation.

When an advance reservation ends, all of its jobs are deleted, whether running or queued. When an occurrence of a standing reservation ends, only its running jobs are deleted; those jobs still in the queue are not deleted.

### 2.32.2.2 Maintenance Reservations

You can create maintenance reservations using `pbs_rsub --hosts <host list>`. Maintenance reservations are designed to make the specified hosts available for the specified amount of time, regardless of what else is happening:

- You can create a maintenance reservation that includes or is made up of vnodes that are down or offline.
- Maintenance reservations ignore the value of a vnode's `resv_enable` attribute.
- PBS immediately confirms any maintenance reservation.
- Maintenance reservations take precedence over other reservations; if you create a maintenance reservation that overlaps an advance or standing job reservation, the overlapping vnodes become unavailable to the job reservation, and the job reservation is in conflict with the maintenance reservation. PBS looks for replacement vnodes; see ["Reservation Fault Tolerance" on page 417 in the PBS Professional Administrator's Guide](#).

PBS will not start any new jobs on vnodes overlapping or in a maintenance reservation. However, jobs that were already running on overlapping vnodes continue to run; you can let them run or requeue them.

You cannot specify `place` or `select` for a maintenance reservation; these are created by PBS:

- PBS creates the reservation's placement specification so that hosts are assigned exclusively to the reservation. The placement specification is always the following:

```
-lplace=exclhost
```

- PBS sets the reservation's `resv_nodes` attribute value so that all CPUs on the reserved hosts are assigned to the maintenance reservation. The select specification is always the following:

```
-lselect=host=<host1>:ncpus=<number of CPUs at host1>+host=<host2>:ncpus=<number of CPUs at host2>+...
```

Maintenance reservations are prefixed with *M*. A maintenance reservation ID has the format:

```
M<sequence number>.<server name>
```

You cannot create a recurring maintenance reservation.

Creating a maintenance reservation does not trigger a scheduling cycle.

You must have manager or operator privilege to create a maintenance reservation.

### 2.32.2.3 Requirements

When using `pbs_rsub` to request a standing, advance, or maintenance reservation, you must specify two of the following options: `-R`, `-E`, and `-D`. The resource request `-l walltime` can be used instead of the `-D` option.



If you want to run jobs in a reservation that will request exclusive placement, you must create the reservation with exclusive placement via `-l place=excl`.

### 2.32.3 Options to `pbs_rsub`

#### `-D <duration>`

Specifies reservation duration. If the start time and end time are the only times specified, this duration time is calculated.

Format: *Duration*

Default: none

#### `-E <end time>`

Specifies the reservation end time. If start time and duration are the only times specified, the end time value is calculated.

Format: *Datetime*.

Default: none

#### `-g <group_list>`

The *group list* is a comma-separated list of group names. The server uses entries in this list, along with an ordered set of rules, to associate a group name with the reservation. The reservation creator's primary group is automatically added to this list.

Format: `<group>@<hostname>[,<group>@<hostname> ...]`

#### `-G <auth group list>`

Comma-separated list of names of groups who can or cannot submit jobs to this reservation. Sets reservation's `Authorized_Groups` attribute to *auth group list*.

This list becomes the `acl_groups` list for the reservation's queue.

More specific entries should be listed before more general, because the list is read left-to-right, and the first match determines access.

If both the `Authorized_Users` and `Authorized_Groups` reservation attributes are set, a user must belong to both in order to be able to submit jobs to this reservation.

Group names are interpreted in the context of the server host, not the context of the host from which the job is submitted.

See the `Authorized_Groups` reservation attribute in [section 6.8, "Reservation Attributes", on page 308](#).

Syntax:

`[+|-]<group name>[, [+|-]<group name> ...]`

Default: No groups are authorized to submit jobs

#### `--hosts <host list>`

Space-separated list of hosts to be included in maintenance reservation. PBS creates placement and resource requests. Placement is always *exclhost*, and all CPUs of requested hosts are assigned to maintenance reservation. Cannot be used with the `-l <placement>`, `-l <resource request>`, or `-I <block time>` options.

Either put this option last, or enclose the list of hosts in quotes. This prevents other arguments from being interpreted as members of the host list. For example:

```
--hosts "hostA hostB hostC"
```

**-H <auth host list>**

Comma-separated list of hosts from which jobs can and cannot be submitted to this reservation. This list becomes the `acl_hosts` list for the reservation's queue. More specific entries should be listed before more general, because the list is read left-to-right, and the first match determines access. If the reservation creator specifies this list, the creator's host is not automatically added to the list.

See the `Authorized_Hosts` reservation attribute in [section 6.8, “Reservation Attributes”, on page 308](#).

Format: `[+|-]<hostname>[+|-]<hostname> ...]`

Default: All hosts are authorized to submit jobs

**-l <block time>**

Specifies interactive mode. The `pbs_rsub` command will block, up to *block time* seconds, while waiting for the reservation request to be confirmed or denied.

If *block time* is positive, and the reservation isn't confirmed or denied in the specified time, the ID string for the reservation is returned with the status "UNCONFIRMED".

If *block time* is negative, and a scheduler doesn't confirm or deny the reservation in the specified time, the reservation is deleted.

Cannot be used with `--hosts` option. Has no effect when used with `--job` option.

Format: *Integer*.

Default: *Not interactive*.

**--job <job ID>**

Immediately creates and confirms a *job-specific now reservation* on the same resources as the job (including resources inherited by the job), and places the job in the job-specific now reservation queue. Sets the job's `create_resv_from_job` attribute to *True*. Sets the now reservation's `reserve_job` attribute to the ID of the job from which the reservation was created, sets the reservation's `Reserve_Owner` attribute to the value of the job's `Job_Owner` attribute, sets the reservation's `resv_nodes` attribute to the job's `exec_vnode` attribute, sets the reservation's resources to match the job's `schedselect` attribute, and sets the reservation's `Resource_List` attribute to the job's `Resource_List` attribute.

The now reservation's duration and start time are the same as the job's walltime and start time. If the job is peer scheduled, the now reservation is created in the pulling complex.

Format: job ID

Default: no default

Example:

```
pbs_rsub --job 1234.myserver
```

Can be used on running jobs only (jobs in the *R* state, with substate 42).

Cannot be used with job arrays, jobs already in reservations, or other users' jobs.

**-l <placement>**

The *placement* specifies how vnodes are reserved. The place statement can contain the following elements, in any order:

```
-l place=[<arrangement>][[:<sharing>]][[:<grouping>]]
```

where

*arrangement*

Whether this reservation chunk is willing to share this vnode or host with other chunks from this reservation. One of *free* | *pack* | *scatter* | *vscatter*

*sharing*

Whether this reservation chunk is willing to share this vnode or host with other reservations or jobs. One of *excl* | *shared* | *exclhost*

*grouping*

Whether the chunks from this reservation should be placed on vnodes that all have the same value for a resource. Can have only one instance of *group=<resource name>*

*free*

Place reservation on any vnode(s).

*pack*

All chunks are taken from one host.

*scatter*

Only one chunk with any MPI processes is taken from a host. A chunk with no MPI processes may be taken from the same vnode as another chunk.

*vscatter*

Only one chunk is taken from any vnode. Each chunk must fit on a vnode.

*excl*

Only this reservation uses the vnodes chosen.

*shared*

This reservation can share the vnodes chosen.

*exclhost*

The entire host is allocated to the reservation.

*group=<resource name>*

Chunks are grouped according to the specified resource. All vnodes in the group must have a common value for *resource*, which can be either the built-in resource **host** or a custom vnode-level resource.

*Resource name* must be a string or a string array.

If you want to run jobs in the reservation that will request exclusive placement, you must create the reservation with exclusive placement via `-l place=excl`.

The place statement cannot start with a colon. Colons are delimiters; use them only to separate parts of a place statement, unless they are quoted inside resource values.

Note that vnodes can have sharing attributes that override reservation placement requests.

See [section 6.10, “Vnode Attributes”, on page 325](#).

Cannot be used with `--hosts` option.

**-l <resource request>**

The *resource request* specifies the resources required for the reservation. These resources are used for the limits on the queue that is dynamically created for the reservation. The aggregate amount of resources for currently running jobs from this queue will not exceed these resource limits. Jobs in the queue that request more of a resource than the queue limit for that resource are not allowed to run. Also, the queue inherits the value of any resource limit set on the server, and these are used for the job if the reservation request itself is silent about that resource. A non-privileged user cannot submit a reservation requesting a custom resource which has been created to be invisible or read-only for users.

Resources are requested by using the -l option, either in chunks inside of selection statements, or in job-wide requests using <resource name>=<value> pairs.

Requesting resources in chunks:

```
-l select=[N:]<chunk>+[N:]<chunk> ...]
```

where *N* specifies how many of that chunk, and a chunk is of the form:

```
<resource name>=<value>[:<resource name>=<value> ...]
```

Requesting job-wide resources:

```
-l <resource name>=<value>[,<resource name>=<value> ...]
```

Default: One chunk containing one CPU.

Cannot be used with --hosts option.

**-m <mail events>**

Specifies the set of events that cause mail to be sent to the list of users specified in the -M <mail list> option.

Format: string consisting of one of the following:

- Any combination of "a", "b", "c" or "e"
- The single character "n"

The following table lists the sub-options to the -m option:

**Table 2-5: Sub-options to -m Option**

| Character | Meaning   |
|-----------|---|
| <i>a</i>  | Notify if the reservation is terminated for whatever reason                             |
| <i>b</i>  | Notify when the reservation period begins   |
| <i>c</i>  | Notify when the reservation is confirmed  |
| <i>e</i>  | Notify when the reservation period ends   |
| <i>n</i>  | Send no mail. Cannot be used with any of <i>a</i> , <i>b</i> , <i>c</i> , or <i>e</i> . |

Default: "ac".

**-M <mail list>**

The list of users to whom mail is sent whenever the reservation transitions to one of the states specified in the -m <mail events> option.

Format: <username>[@<hostname>][,<username>[@<hostname>]...]

Default: Reservation owner.

**-N <reservation name>**

Specifies a name for the reservation.

Format: *Reservation Name*. See ["Reservation Name" on page 362](#).

Default: None.

**-q <server>**

Specifies the server at which to create the reservation.

Default: Default server

**-r <recurrence rule>**

Specifies rule for recurrence of standing reservations. Rule must conform to iCalendar syntax, and is specified using a subset of parameters from RFC 2445.

Valid syntax for *recurrence rule* takes one of two forms:

*FREQ*=<*freq spec*>;*COUNT*=<*count spec*>;<*interval spec*>

or

*FREQ*=<*freq spec*>;*UNTIL*=<*until spec*>;<*interval spec*>

where

*freq spec*

Frequency with which the standing reservation repeats. Valid values are:

**WEEKLY|DAILY|HOURLY**

*count spec*

The exact number of occurrences. Number up to 4 digits in length.

Format: *Integer*.

*interval spec*

Specifies interval. Format is one or both of:

**BYDAY=MO|TU|WE|TH|FR|SA|SU**

or

**BYHOUR=0|1|2|...|23**

When using both, separate them with a semicolon.

Elements specified in the recurrence rule override those specified in the arguments to the -R and -E options.

For example, the BYHOUR specification overrides the hourly part of the -R option. For example, -R 0730 -E 0830 ... BYHOUR=9 results in a reservation that starts at 9:30 and runs for 1 hour.

*until spec*

Occurrences will start up to but not after date and time specified. Format:

<YYYYMMDD>[T<HHMMSS>]

Note that the year-month-day section is separated from the hour-minute-second section by a capital T.

Requirements:

- The recurrence rule must be on one unbroken line and must be enclosed in double quotes.
- A start and end date must be used when specifying a recurrence rule. See the R and E options.
- The PBS\_TZID environment variable must be set at the submission host. The format for PBS\_TZID is a timezone location. Examples: `America/Los_Angeles`, `America/Detroit`, `Europe/Berlin`, `Asia/Calcutta`. See the PBS Professional User's Guide.
- Spaces are not allowed.

Examples of Standing Reservations

For a reservation that runs every day from 8am to 10am, for a total of 10 occurrences:

```
pbs_rsub -R 0800 -E 1000 -r "FREQ=DAILY;COUNT=10"
```

Every weekday from 6am to 6pm until December 10 2008

```
pbs_rsub -R 0600 -E 1800 -r "FREQ=WEEKLY;BYDAY=MO,TU,WE,TH,FR;UNTIL=20081210"
```

Every week from 3pm to 5pm on Monday, Wednesday, and Friday, for 9 occurrences, i.e., for three weeks:

```
pbs_rsub -R 1500 -E 1700 -r "FREQ=WEEKLY;BYDAY=MO,WE,FR;COUNT=3"
```

#### -R <start time>

Specifies reservation starting time. If the reservation's end time and duration are the only times specified, this start time is calculated.

If the day, *DD*, is not specified, it defaults to today if the time *hhmm* is in the future. Otherwise, the day is set to tomorrow. For example, if you submit a reservation with the specification `-R 1110` at 11:15 a.m., it is interpreted as being for 11:10am tomorrow. If the month portion, *MM*, is not specified, it defaults to the current month, provided that the specified day *DD*, is in the future. Otherwise, the month is set to next month. Similar rules apply to the two other optional, left-side components.

Format: *Datetime*

#### -u <user list>

Not used. Comma-separated list of user names.

Format: `<username>[@<hostname>][,<username>[@<hostname>] ...]`

Default: None.

#### -U <auth user list>

Comma-separated list of users who are and are not allowed to submit jobs to this reservation. Sets reservation's `Authorized_Users` attribute to *auth user list*.

This list becomes the `acl_users` attribute for the reservation's queue.

More specific entries should be listed before more general, because the list is read left-to-right, and the first match determines access. The reservation creator's username is automatically added to this list, whether or not the reservation creator specifies this list.

If both the `Authorized_Users` and `Authorized_Groups` reservation attributes are set, a user must belong to both in order to be able to submit jobs to this reservation.

See the `Authorized_Users` reservation attribute in [section 6.8, "Reservation Attributes", on page 308](#).

Syntax:

```
[+|-]<username>[@<hostname>][,[+|-]<username>[@<hostname>]...]
```

Default: Job owner only.

#### -W<extended options>

This allows you to define other attributes for the reservation or perform other actions.

`delete_idle_time=<allowed idle time>`

Deletes the reservation after the specified amount of idle time. Applies to each instance of a standing reservation.

The default value for the `delete_idle_time` attribute for an ASAP reservation is 10 minutes.

`qmove=<job ID> [-I -<timeout>]`

Takes as input a queued job, creates a *job-specific ASAP reservation* for the same resources the job requests, and moves the job into the reservation's queue. The reservation is scheduled to run as soon as possible.

When the reservation is created, it inherits its resources from the job, not from the resources requested through the `pbs_rsub` command.

You can use the `-I` option to specify a timeout for the conversion. If you use the `qmove` option to convert a job to a reservation, and the reservation is not confirmed within the timeout period, the reservation is deleted. The default timeout period is *10 seconds*. There is no option for this kind of reservation to be unconfirmed.

To specify the timeout, you must give a negative value for the `-I` option. For example, to specify a timeout of 300 seconds:

```
pbs_rsub -Wqmove=<job ID> -I -300
```

The default value for the `delete_idle_time` attribute for an ASAP reservation is 10 minutes.

The `-R` and `-E` options to `pbs_rsub` are disabled when using the `qmove=<job ID>` option.

Some shells require that you enclose a job array ID in double quotes.

Can be used on queued jobs only.

`--version`

The `pbs_rsub` command returns its PBS version information and exits. This option can only be used alone.

## 2.32.4 Output

The `pbs_rsub` command returns the reservation identifier.

Format for an advance or job-specific reservation:

*R<sequence number>.<server name>*

The associated queue's name is the prefix, *R<sequence number>*.

Format for a standing reservation:

*S<sequence number>.<server name>*

The associated queue's name is the prefix, *S<sequence number>*.

Format for a maintenance reservation:

*M<sequence number>.<server name>*

## 2.32.5 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["pbs\\_rstat" on page 97](#), ["pbs\\_rdel" on page 93](#), ["Reservation Attributes" on page 308](#)

## 2.33 pbs\_sched

Runs a PBS scheduler

### 2.33.1 Synopsis

```
pbs_sched [-a <alarm>] [-c <clientsfile>] [-d <home dir>] [-I <scheduler name>] [-L <logfile>] [-n] [-N] [-p
<output file>] [-t <num threads>]
```

```
pbs_sched --version
```

### 2.33.2 Description

Runs the default scheduler or a multisched.

#### 2.33.2.1 Required Permission

pbs\_sched must be executed with root permission.

### 2.33.3 Options to pbs\_sched

**-c <clientsfile>**

Add clients to this scheduler's list of known clients. The *clientsfile* contains single-line entries of the form

```
$clienthost <hostname>
```

Each *hostname* is added to the list of hosts allowed to connect to this scheduler. If *clientsfile* cannot be opened, this scheduler aborts. Path can be absolute or relative. If relative, it is relative to `PBS_HOME/sched_priv/`.

**-d <home dir>**

The directory in which this scheduler will run.

Default: `PBS_HOME/sched_priv`.

**-I <scheduler name>**

Name of scheduler to start. Required when starting a multisched.

**-L <logfile>**

The absolute path and filename of the log file. This scheduler writes its PBS version and build information to *logfile* whenever it starts up or *logfile* is rolled to a new file.

See the `-d` option.

Default: This scheduler opens a file named for the current date in the `PBS_HOME/sched_log` directory.

**-n**

Tells this scheduler to not restart itself if it receives a `sigsegv` or a `sigbus`. A scheduler by default restarts itself if it receives either of these two signals more than five minutes after starting. A scheduler does not restart itself if it receives either one within five minutes of starting.

**-N**

Runs the scheduler in standalone mode.



**-p <output file>**

Any output which is written to standard out or standard error is written to *output file*. The pathname can be absolute or relative, in which case it is relative to `PBS_HOME/sched_priv`.

See the `-d` option.

Default: `PBS_HOME/sched_priv/sched_out`

**-t <num threads>**

Specifies number of threads for this scheduler.

Scheduler automatically caps number of threads at the number of cores (or hyperthreads if applicable), regardless of value of *num threads*.

Overrides `PBS_SCHED_THREADS` environment variable and `PBS_SCHED_THREADS` parameter in `pbs.conf`.

Valid values:  $\geq 1$

Default: one thread

**--version**

The `pbs_sched` command returns its PBS version information and exits. This option can only be used alone.

## 2.33.4 Signal Handling

All signals are ignored until the end of the cycle. Most signals are handled in the standard UNIX fashion.

**SIGHUP**

This scheduler closes and reopens its log file and rereads its configuration file if one exists.

**SIGALRM, SIGBUS, etc.**

Ignored until end of scheduling cycle. This scheduler quits.

**SIGINT and SIGTERM**

This scheduler closes its log file and shuts down.

All other signals have the default action installed.

## 2.33.5 Exit Status

**Zero**

Upon normal termination

## 2.33.6 See Also

The PBS Professional Administrator's Guide

## 2.34 pbs\_server

Starts a PBS batch server

### 2.34.1 Synopsis

```
pbs_server [-A <acctfile>] [-a <active>] [-C] [-d <config path>] [-e <mask>] [-F <delay>] [-L <logfile>] [-M
  <MoM port>] [-N] [-p <port number>] [-R <MoM RM port>] [-s <replacement string>] [-t <restart type>]
pbs_server --version
```

### 2.34.2 Description

The `pbs_server` command starts a batch server on the local host. Typically, this command is in a local boot file such as `/etc/rc.local`. If the batch server is already running, `pbs_server` exits with an error.

#### 2.34.2.1 Required Permission

To ensure that the `pbs_server` command is not runnable by the general user community, the server runs only if its real and effective UID is zero. You must be root.

### 2.34.3 Options to pbs\_server

#### -A <acctfile>

Specifies an absolute path name for the file to use as the accounting file. If not specified, the file is named for the current date in the `PBS_HOME/server_priv/accounting` directory.

#### -a <value>

When *True*, the server is in state "*active*" and the default scheduler is called to schedule jobs. When *False*, the server is in state "*idle*" and the default scheduler is not called to schedule jobs. Sets the server's scheduling attribute. If this option is not specified, the server uses the previously specified *value* for the scheduling attribute.

Format: *Boolean*

#### -C

The server starts up, creates the database, and exits. Windows only.

#### -d <config path>

Specifies the absolute path to the directory containing the server configuration files, `PBS_HOME`. A host may have multiple servers. Each server must have a different configuration directory. The default configuration directory is specified in `$PBS_HOME`, and is typically `/var/spool/pbs`.

#### -e <mask>

Specifies a log event mask to be used when logging. See "`log_events`" in [section 6.6, "Server Attributes", on page 285](#).

#### -F <delay>

Specifies the number of seconds that the secondary server should wait before taking over when it believes the primary server is down. If the number of seconds is specified as `-1`, the secondary will make one attempt to contact the primary and then become active.

Default: *30 seconds*

**-L <logfile>**

Specifies the absolute path name for the log file. If not specified, the file is named for the current date in the `PBS_HOME/server_logs` directory. `PBS_HOME` is specified in the `$PBS_HOME` environment variable or in `/etc/pbs.conf`; see the `-d` option.

**-M <MoM port>**

Specifies the hostname and/or port number on which the server should connect to MoM. The option argument, *MoM port*, uses the syntax:

`[<hostname>][:<port number>]`

If *hostname* not specified, the local host is assumed.

If *port number* is not specified, the default port is assumed.

See the `-M` option in [section 2.23, “pbs\\_mom”, on page 74](#).

Default: `15002`

**-N**

Runs the server in standalone mode.

**-p <port number>**

Specifies the port number on which the server is to listen for batch requests. If multiple servers are running on a single host, each must have its own unique port number. This option is for testing with multiple batch systems on a single host.

Format: Integer port number

Default: `15001`

**-R <MoM RM port>**

Specifies the port number on which the server should query the up/down status of MoM. See the `-R` option in [section 2.23, “pbs\\_mom”, on page 74](#).

Default: `15003`

**-s <replacement string>**

Specifies the string to use when replacing spaces in accounting entity names. Only available under Windows.

**-t <restart type>**

Specifies behavior when the server restarts. The *restart type* argument is one of the following:

**cold**

All jobs are purged. Positive confirmation is required before this direction is accepted.

**create**

The server discards any existing configuration files: server, nodes, queues, and jobs, and initializes configuration files to the default values. The default scheduler is idled (`scheduling` is set to *False*). Any multi-scheds are deleted.

**hot**

All jobs in the *Running* state are retained in that state. Any job that was requeued into the *Queued* state from the *Running* state when the server last shut down is run immediately, assuming the required resources are available. This returns the server to the same state as when it went down. After those jobs are restarted, normal scheduling takes place for all remaining queued jobs. All other jobs are retained in their current state.

If a job cannot be restarted immediately because of a missing resource, such as a vnode being down, the server attempts to restart it periodically for up to 5 minutes. After that period, the server will revert to a normal state, as if *warm* started, and will no longer attempt to restart any remaining jobs which were running prior to the shutdown.

**updatedb**

Updates format of PBS data from the previous format to the data service format.

**warm**

All jobs in the *Running* state are retained in that state. All other jobs are maintained in their current state. The default scheduler typically chooses new jobs for execution. *warm* is the default if *-t* is not specified.

**--version**

The `pbs_server` command returns its PBS version information and exits. This option can only be used alone.

## 2.34.4 Files

**\$PBS\_HOME/server\_priv**

Default directory for configuration files.

**\$PBS\_HOME/server\_logs**

Directory for log files recorded by the server.

## 2.34.5 Signal Handling for pbs\_server

When it receives the following signals, the server performs the following actions:

**SIGHUP**

The current server log and accounting log are closed and reopened. This allows for the prior log to be renamed and a new log started from the time of the signal.

**SIGTERM**

Causes a rapid orderly shutdown of `pbs_server`, identical to "`qterm -t quick`".

**SIGSHUTDN**

On systems where `SIGSHUTDN` is defined, causes an orderly "*quick*" shutdown of the server.

**SIGPIPE, SIGUSR1, SIGUSR2**

These signals are ignored.

All other signals have their default behavior installed.

## 2.34.6 Diagnostic Messages

The server records a diagnostic message in a log file for any error occurrence. The log files are maintained in the `server_logs` directory below the home directory of the server. If the log file cannot be opened, the diagnostic message is written to the system console. The server writes its PBS version and build information to the logfile whenever it starts up or the logfile is rolled to a new file.

## 2.34.7 Stopping the PBS Server

### 2.34.7.1 Stopping the Server on Linux

Use the `qterm` command (see [section 2.60, “qterm”, on page 241](#)):

**qterm**

or send a `SIGTERM`:

**kill <server PID>**

---

## 2.34.8 Exit Status

Zero

When the server has run in the background and then exits

Greater than zero

If the server daemon fails to begin batch operation

## 2.34.9 See Also

The *PBS Professional Administrator's Guide*

## 2.35 pbs\_snapshot

Linux only. Captures PBS workload and configuration data

### 2.35.1 Synopsis

```
pbs_snapshot -h, --help
```

```
pbs_snapshot -o <output directory path> [--accounting-logs=<number of days>] [--additional-hosts=<hostname list>] [--basic] [--config-only] [--daemon-logs=<number of days>] [-H <server host>] [-l <log level>] [--map=<file path>] [--obfuscate] [--with-sudo]
```

```
pbs_snapshot [--obf-snap <path to snapshot>]
```

```
pbs_snapshot --version
```

### 2.35.2 Description

You use `pbs_snapshot` to capture PBS workload and configuration data. This tool is written in Python and uses PTL libraries, including `PBSSnapUtils`, to extract the data. You can optionally anonymize the PBS data during or after capturing it. The `pbs_snapshot` command captures data from all multischeds. The command detects which daemon or daemons are running on the host where it is collecting information, and captures daemon and system data accordingly. If no PBS daemons are running, the command collects system information. The output tarball contains information about the host specified via the `-H` option, or if that is not specified, the local host. If you specify additional hosts, the command creates a tarball for each additional host and includes it as a sub-tarball in the output.

- To supply information for simulation that you will use to tune your site, capture standard PBS configuration and node information via the `--basic` option.
- To supply information to PBS Cloud, capture PBS configuration file information via the `--config-only` option.
- For debugging your site, capture everything via the default behavior (do not specify `--basic` or `--config-only`).

#### 2.35.2.1 Required Privilege

The `pbs_snapshot` command allows you to use the `sudo` infrastructure provided by the PTL framework to capture root-owned information via `--with-sudo`. All other information is collected as a normal user. If you need to run `pbs_snapshot` as a non-privileged user, and without using the PTL `--with-sudo` infrastructure, you must be root if you want root-owned information to be collected.

#### 2.35.2.2 Restrictions

The `pbs_snapshot` command is not available on Windows.

---

### 2.35.3 Options to `pbs_snapshot`

#### `--accounting-logs=<number of days>`

Specifies number of days of accounting logs to be collected; this count includes the current day.

Value of *number of days* must be  $\geq 0$ :

- If number of days is 0, no logs are captured.
- If number of days is 1, only the logs for the current day are captured.

Default: `pbs_snapshot` collects 30 days of accounting logs

#### `--additional-hosts=<hostname list>`

Specifies that `pbs_snapshot` should gather data from the specified list of additional hosts. Launches the `pbs_snapshot` command on each specified host, creates a tarball there named `<hostname>_snapshot.tgz`, and includes it as a sub-tarball in the output for the main output. If you use the `--with-sudo` option, each launched copy uses that option as well.

The command does not query the server when it runs at a non-server host.

The command collects a full snapshot, including the following information:

- Daemon logs, for the number of days of logs being captured, specified via the `--daemon-logs=<number of days>` option
- The `PBS_HOME/<daemon>_priv` directory
- Accounting logs if server daemon runs on host
- System information

Format for *hostname list* is a comma-separated list of one or more hostnames:

`<hostname>[, <hostname> ...]`

**--basic**

Captures basic PBS configuration and node information only. Captures the following:

**Table 2-6: PBS Configuration Information Captured with --basic Option**

| Directory or File                          | Output File                              | Description of Captured Information                  |
|--|--|--|
| pbs.conf                                   |  | Copy of /etc/pbs.conf on server host                 |
| server                                     | qstat_Bf.out                             | Output of <code>qstat -Bf</code>                     |
|  | qstat_Qf.out                             | Output of <code>qstat -Qf</code>                     |
| server_priv                                | resourcedef                              | Copy of server_priv/resourcedef file                 |
|  | config                                   | Copy of server_priv/config file                      |
| scheduler                                  | qmgr_lsched.out                          | Output of <code>qmgr -c 'list sched'</code>          |
| sched_priv for each scheduler instance     | sched_priv                               | Copy of each scheduler's sched_priv directory        |
| hook                                       | qmgr_lpbshook.out                        | Output of <code>qmgr -c 'list pbshook'</code>        |
|  | qmgr_ph_default.out                      | Output of <code>qmgr -c 'print hook @default'</code> |
| mom_priv on server host only, if it exists | config on server host only, if it exists | Copy of mom_priv/config file                         |
| node                                       | pbsnodes_va.out                          | Output of <code>pbsnodes -va</code>                  |
| reservation                                | pbs_rstat_f.out                          | Output of <code>pbs_rstat -f</code>                  |
| job  | qstat_f.out                              | Output of <code>qstat -f</code>                      |
| system                                     | os_info                                  | OS information                                       |
|  | pbs_environment                          | Copy of pbs_environment file                         |
| pbs_snapshot.log                           |  | Log of pbs_snapshot execution                        |
| ctime                                      |  | Timestamp of when the snapshot was taken             |

Can be combined with other options such as `--accounting-logs` and `--daemon-logs` in order to capture additional information.

We also list the contents in [section 2.35.4.2, “Output Contents”, on page 119](#).



**--config-only**

Captures PBS configuration file information only. Captures the following:

**Table 2-7: PBS Configuration Information Captured with --config-only Option**

| Directory or File                           | Output File                              | Description of Captured Information                  |
|---|--|--|
| pbs.conf                                    |  | Copy of /etc/pbs.conf on server host                 |
| server                                      | qstat_Bf.out                             | Output of <code>qstat -Bf</code>                     |
|   | qstat_Qf.out                             | Output of <code>qstat -Qf</code>                     |
| server_priv                                 | resourcedef                              | Copy of server_priv/resourcedef file                 |
|   | config                                   | Copy of server_priv/config file                      |
| scheduler                                   | qmgr_lsched.out                          | Output of <code>qmgr -c 'list sched'</code>          |
| sched_priv for each scheduler instance      | dedicated_time                           | Copy of dedicated_time file                          |
|   | holidays                                 | Copy of holidays file                                |
|   | resource_group                           | Copy of resource_group file                          |
|   | sched_config                             | Copy of sched_config file                            |
| hook  | qmgr_lpbshook.out                        | Output of <code>qmgr -c 'list pbshook'</code>        |
|   | qmgr_ph_default.out                      | Output of <code>qmgr -c 'print hook @default'</code> |
| mom_priv only for server host, if it exists | config on server host only, if it exists | Copy of mom_priv/config file                         |
| system                                      | os_info                                  | OS information                                       |
|   | pbs_environment                          | Copy of pbs_environment file                         |
| pbs_snapshot.log                            |  | Log of pbs_snapshot execution                        |
| ctime                                       |  | Timestamp of when the snapshot was taken             |

Can be combined with other options such as `--accounting-logs` and `--daemon-logs` in order to capture additional information.

We also list the contents in [section 2.35.4.2, “Output Contents”, on page 119](#).

**--daemon-logs=<number of days>**

Specifies number of days of daemon logs to be collected; this count includes the current day.

Value of *number of days* must be  $\geq 0$ :

- If number of days is 0, no logs are captured.
- If number of days is 1, only the logs for the current day are captured.

Default: `pbs_snapshot` collects 5 days of daemon logs

**-h, --help**

Prints usage and exits.

**-H <hostname>**

Specifies hostname for host whose retrieved data is to be at the top level in the output tarball. If not specified, `pbs_snapshot` puts data for the local host at the top level in the output tarball.

**-l <log level>**

Specifies level at which `pbs_snapshot` writes its log. The log file is `pbs_snapshot.log`, in the output directory path specified using the `-o <output directory path>` option.

Valid values, from most comprehensive to least: *DEBUG2*, *DEBUG*, *INFOCLI2*, *INFOCLI*, *INFO*, *WARNING*, *ERROR*, *FATAL*

Default: *INFOCLI2*

**--map=<file path>**

Specifies path for file containing obfuscation map, which is a `<key>:<value>` pair-mapping of obfuscated data. Path can be absolute or relative to current working directory.

Default: `pbs_snapshot` writes its obfuscation map in a file called "obfuscate.map" in the location specified via the `-o <output directory path>` option.

Can only be used with the `--obfuscate` option.

**-o <output directory path>**

Path to directory where `pbs_snapshot` writes its output tarball. Required. Path can be absolute or relative to current working directory.

For example, if you specify "`-o /tmp`", `pbs_snapshot` writes "`/tmp/snapshot_<timestamp>.tgz`".

The output directory path must already exist.

**--obfuscate**

Obfuscates (anonymizes) or deletes sensitive PBS data being captured by `pbs_snapshot`.

- Obfuscates the following data: `euser`, `egroup`, `project`, `Account_Name`, `operators`, `managers`, `group_list`, `Mail_Users`, `User_List`, `server_host`, `acl_groups`, `acl_users`, `acl_resv_groups`, `acl_resv_users`, `sched_host`, `acl_resv_hosts`, `acl_hosts`, `Job_Owner`, `exec_host`, `Host`, `Mom`, `resources_available.host`, `resources_available.vnode`
- Deletes the following data: `Variable_List`, `Error_Path`, `Output_Path`, `mail_from`, `Mail_Points`, `Job_Name`, `jobdir`, `Submit_arguments`, `Shell_Path_List`

**--obf-snap <path to snapshot>**

Obfuscates (anonymizes) or deletes sensitive PBS data already captured in an existing snapshot. Path can be a snapshot `.tar` file previously generated by `pbs_snapshot`, or a directory created by untarring a snapshot. Obfuscated snapshot is created with the name "`<directory or original snapshot>_obf.tgz`".

- Obfuscates the following data: `euser`, `egroup`, `project`, `Account_Name`, `operators`, `managers`, `group_list`, `Mail_Users`, `User_List`, `server_host`, `acl_groups`, `acl_users`, `acl_resv_groups`, `acl_resv_users`, `sched_host`, `acl_resv_hosts`, `acl_hosts`, `Job_Owner`, `exec_host`, `Host`, `Mom`, `resources_available.host`, `resources_available.vnode`
- Deletes the following data: `Variable_List`, `Error_Path`, `Output_Path`, `mail_from`, `Mail_Points`, `Job_Name`, `jobdir`, `Submit_arguments`, `Shell_Path_List`

If the snapshot contains snapshots of multiple hosts, each snapshot must be obfuscated individually.

**--version**

The `pbs_snapshot` command prints its PBS version information and exits. Can only be used alone.

**--with-sudo**

Uses the PTL `sudo` infrastructure in order capture root-owned information via `sudo`. (Information not owned by root is captured using normal privilege, not root privilege.) With this option, you do not need to prefix your `pbs_snapshot` command with `sudo`, and you do not need root privilege.

## 2.35.4 Output

### 2.35.4.1 Output Location

You must use the `-o <output directory path>` option to specify the directory where `pbs_snapshot` writes its output. The path can be absolute or relative to current working directory. The output directory must already exist. As an example, if you specify `-o /tmp`, `pbs_snapshot` writes `/tmp/snapshot_<timestamp>.tgz`.

### 2.35.4.2 Output Contents

The `pbs_snapshot` command writes the output for the local host and each specified remote host as a tarball. Tarballs for remote hosts are included in the main tarball.

The command captures JSON output from `qstat-f -F json` and `pbsnodes -av -F json`.

The main tarball contains the following directory structure, files, and tarballs, and lists which of those elements appear in a tarball produced by the `--basic` and `--config-only` options:

**Table 2-8: Contents of Snapshot**

| Directory or File | Directory Contents  | Description   | In Basic    | In Config Only        |
|-------------------|---|---|-------------|-----------------------|
| server/           | qstat_B.out   | Output of <code>qstat -B</code>   |             |                       |
|                   | qstat_Bf.out  | Output of <code>qstat -Bf</code>  | Yes         | Yes                   |
|                   | qmgr_ps.out   | Output of <code>qmgr print server</code>  |             |                       |
|                   | qstat_Q.out   | Output of <code>qstat -Q</code>   |             |                       |
|                   | qstat_Qf.out  | Output of <code>qstat -Qf</code>  | Yes         | Yes                   |
|                   | qmgr_pr.out   | Output of <code>qmgr print resource</code>  |             |                       |
| server_priv/      | Copy of the <code>PBS_HOME/server_priv</code> directory.<br>Core files are captured separately; see <code>core_file_bt/</code> .        |   | resourcedef | resourcedef<br>config |
|                   | accounting/   | Accounting logs from <code>PBS_HOME/server_priv/accounting/</code> directory for the number of days specified via <code>--accounting-logs</code> option |             |                       |
| server_logs/      | Server logs from the <code>PBS_HOME/server_logs</code> directory for the number of days specified via <code>--daemon-logs</code> option |   |             |                       |

Table 2-8: Contents of Snapshot

| Directory or File | Directory Contents   | Description                        | In Basic | In Config Only                                |
|-------------------|--|------------------------------------|----------|---|
| job/              | qstat.out  | Output of qstat                    |          |   |
|                   | qstat_f.out  | Output of qstat -f                 | Yes      |   |
|                   | qstat_f_F_json.out   | Output of qstat -f -F json         |          |   |
|                   | qstat_t.out  | Output of qstat -t                 |          |   |
|                   | qstat_tf.out   | Output of qstat -tf                |          |   |
|                   | qstat_x.out  | Output of qstat -x                 |          |   |
|                   | qstat_xf.out   | Output of qstat -xf                |          |   |
|                   | qstat_ns.out   | Output of qstat -ns                |          |   |
|                   | qstat_fx_F_dsv.out   | Output of qstat -fx -F dsv         |          |   |
|                   | qstat_f_F_dsv.out  | Output of qstat -f -F dsv          |          |   |
| node/             | pbsnodes_va.out  | Output of pbsnodes -va             | Yes      |   |
|                   | pbsnodes_a.out   | Output of pbsnodes -a              |          |   |
|                   | pbsnodes_avSj.out  | Output of pbsnodes -avSj           |          |   |
|                   | pbsnodes_aSj.out   | Output of pbsnodes -aSj            |          |   |
|                   | pbsnodes_avS.out   | Output of pbsnodes -avS            |          |   |
|                   | pbsnodes_aS.out  | Output of pbsnodes -aS             |          |   |
|                   | pbsnodes_aFdsv.out   | Output of pbsnodes -aF dsv         |          |   |
|                   | pbsnodes_avFdsv.out  | Output of pbsnodes -avF dsv        |          |   |
|                   | pbsnodes_avFjson.out   | Output of pbsnodes -avF json       |          |   |
|                   | qmgr_pn_default.out  | Output of qmgr print node @default |          |   |
| mom_priv/         | Copy of the PBS_HOME/mom_priv directory.<br>Core files are captured separately; see core_file_bt/.   |                                    |          | mom_priv/con<br>fig, only from<br>server host |
| mom_logs/         | MoM logs from the PBS_HOME/mom_logs directory for the number of days specified via --daemon-logs option  |                                    |          |   |
| comm_logs/        | Comm logs from the PBS_HOME/comm_logs directory for the number of days specified via --daemon-logs option  |                                    |          |   |
| sched_priv/       | Copy of the PBS_HOME/sched_priv directory, with all files.<br>Core files are not captured; see core_file_bt/.  |                                    | Yes      |   |
| sched_logs/       | Scheduler logs from the PBS_HOME/sched_log directory. For a snapshot of a live PBS complex, this is for the number of days specified via pbs_snapshot --daemon-logs. For a simulation output snapshot, this is for the time simulated via simsh <path to snapshot> sim -L. |                                    |          |   |

Table 2-8: Contents of Snapshot

| Directory or File             | Directory Contents  | Description   | In Basic | In Config Only   |
|-------------------------------|---|---|----------|--|
| sched_priv_<multisched name>/ | Copy of the PBS_HOME/sched_priv_<multisched name> directory, with all files.<br>Core files are not captured; see core_file_bt/.   |   | Yes      | dedicated_time<br>holidays<br>resource_group<br>sched_config |
| sched_logs_<multisched name>/ | Multisched logs from the PBS_HOME/sched_log_<multisched name> directory for the number of days specified via --daemon-logs option |   |          |  |
| reservation/                  | pbs_rstat_f.out   | Output of pbs_rstat -f  | Yes      |  |
|                               | pbs_rstat.out   | Output of pbs_rstat   |          |  |
| scheduler/                    | qmgr_lsched.out   | Output of qmgr list sched   | Yes      | Yes  |
| hook/                         | qmgr_ph_default.out   | Output of qmgr -c 'print hook @default'   |          | Yes  |
|                               | qmgr_lpbshook.out   | Output of qmgr -c 'list pbshook'  | Yes      | Yes  |
| datastore/                    | pg_log/   | Copy of the PBS_HOME/datastore/pg_log directory for the number of days specified via --daemon-logs option |          |  |

Table 2-8: Contents of Snapshot

| Directory or File | Directory Contents              | Description  | In Basic | In Config Only |
|-------------------|---------------------------------|--|----------|----------------|
| core_file_bt/     | Stack backtrace from core files |  |          |                |
|                   | sched_priv/                     | Files containing the output of <code>thread apply all backtrace full</code> on all core files captured from <code>PBS_HOME/sched_priv</code>                         |          |                |
|                   | sched_priv_<multi-sched name>   | Files containing the output of <code>thread apply all backtrace full</code> on all core files captured from <code>PBS_HOME/sched_priv_&lt;multisched name&gt;</code> |          |                |
|                   | server_priv/                    | Files containing the output of <code>thread apply all backtrace full</code> on all core files captured from <code>PBS_HOME/server_priv</code>                        |          |                |
|                   | mom_priv/                       | Files containing the output of <code>thread apply all backtrace full</code> on all core files captured from <code>PBS_HOME/mom_priv</code>                           |          |                |
|                   | misc/                           | Files containing the output of <code>thread apply all backtrace full</code> on any other core files found inside <code>PBS_HOME</code>                               |          |                |

Table 2-8: Contents of Snapshot

| Directory or File      | Directory Contents  | Description   | In Basic | In Config Only |
|------------------------|---|---|----------|----------------|
| system/                | pbs_probe_v.out   | Output of <code>pbs_probe -v</code>   |          |                |
|                        | pbs_hostn_v.out   | Output of <code>pbs_hostn -v \$(hostname)</code>  |          |                |
|                        | pbs_environment   | Copy of <code>PBS_HOME/pbs_environment</code> file  |          | Yes            |
|                        | os_info   | Information about the OS  |          | Yes            |
|                        | process_info  | List of processes running on the system when the snapshot was taken. Output of <code>ps -aux   grep [p]bs</code> on Linux systems, or <code>tasklist /v</code> on Windows systems |          |                |
|                        | ps_leaf.out   | Output of <code>ps -leaf</code> . Linux only.   |          |                |
|                        | lsof_pbs.out  | Output of <code>lsof   grep [p]bs</code> . Linux only.  |          |                |
|                        | etc_hosts   | Copy of <code>/etc/hosts</code> file. Linux only.   |          |                |
|                        | etc_nsswitch_conf   | Copy of <code>/etc/nsswitch.conf</code> file. Linux only.   |          |                |
|                        | vmstat.out  | Output of the command <code>vmstat</code> . Linux only.   |          |                |
|                        | df_h.out  | Output of the command <code>df -h</code> . Linux only.  |          |                |
|                        | dmesg.out   | Output of the <code>dmesg</code> command. Linux only.   |          |                |
| pbs.conf               | Copy of the <code>pbs.conf</code> file on the server host                             |   | Yes      | Yes            |
| ctime                  | Contains the time in seconds since epoch when the snapshot was taken                  |   | Yes      | Yes            |
| pbs_snapshot.log       | Log messages written by <code>pbs_snapshot</code>                                     |   | Yes      | Yes            |
| <remote host-name>.tgz | Tarball of output from running the <code>pbs_snapshot</code> command at a remote host |   |          |                |

## 2.35.5 Examples

```
pbs_snapshot -o /tmp
```

Writes a snapshot to `/tmp/snapshot_<timestamp>.tgz` that includes 30 days of accounting logs and 5 days of daemon logs from the server host.

```
pbs_snapshot --daemon-logs=1 --accounting-logs=1 -o /tmp --obfuscate --map=mapfile.txt
```

Writes a snapshot to `/tmp/snapshot_<timestamp>.tgz` that includes 1 day of accounting and daemon logs. Obfuscates the data and stores the data mapping in the map file named "mapfile.txt".



---

## 2.36 pbs\_tclsh

**Deprecated.** TCL shell with TCL-wrapped PBS API

### 2.36.1 Synopsis

*pbs\_tclsh*

*pbs\_tclsh --version*

### 2.36.2 Description

The `pbs_tclsh` command starts a version of the TCL shell which includes wrapped versions of the PBS external API. The PBS TCL API is documented in ["TCL/tk Interface" on page 105 in the PBS Professional Programmer's Guide](#).

The `pbs_tclsh` command is used to query MoM. For example:

```
> pbs_tclsh
tclsh> openrm <hostname>
<file descriptor>
tclsh> addreq <file descriptor> "loadave"
tclsh> getreq <file descriptor>
<load average>
tclsh> closereq <file descriptor>
```

#### 2.36.2.1 Required Permission

Root privilege is required in order to query MoM for dynamic resources. Root privilege is not required in order to query MoM for built-in resources and site-defined static resources.

### 2.36.3 Options

`--version`

The `pbs_tclsh` command returns its PBS version information and exits. This option can only be used alone.

### 2.36.4 Standard Error

The `pbs_tclsh` command writes a diagnostic message to standard error for each error occurrence.

### 2.36.5 See Also

The PBS Professional Administrator's Guide, the PBS Programmer's Guide, ["pbs\\_wish" on page 132](#)

## 2.37 pbs\_tmrsh

TM-enabled replacement for `rsh`/`ssh` for use by MPI implementations

### 2.37.1 Synopsis

```
pbs_tmrsh <hostname> [-l <username>] [-n] <command> [<args> ...]  
pbs_tmrsh --version
```

### 2.37.2 Description

The `pbs_tmrsh` command attempts to emulate an "`rsh`" connection to the specified host, via underlying calls to the Task Management (TM) API. The program is intended to be used during MPI integration activities, and not by end-users.

Running "`pbs_tmrsh <hostname> <command>`" causes a PBS task to be started on *hostname* running *command*.

#### 2.37.2.1 Requirements for Environment Variables

The environment variables used by the two MPI implementations to point to the `rsh` work-alike (`MPI_REMSH` in the case of HP and `P4_RSHCOMMAND` for MPICH) must be set in the job environment and point to the full path for `pbs_tmrsh`.

The file `$PBS_HOME/pbs_environment` should contain the environment variable `PATH` in which to search for the program executable. This applies to both Windows and Linux. It is expected that a full path will be specified for the *command* and the `PATH` variable will not be needed.

### 2.37.3 Options

`-l <username>`

Specifies the username under which to execute the task. If used, *username* must match the username running the `pbs_tmrsh` command.

`-n`

A no-op; provided for MPI implementations that expect to call `rsh` with the "`-n`" option.

`--version`

The `pbs_tmrsh` command returns its PBS version information and exits. This option can only be used alone.

### 2.37.4 Operands

*command*

Specifies command to be run as a PBS task.

*hostname*

Specifies host on which to run PBS task. The *hostname* may be specified in IP-dot-address form.

### 2.37.5 Output and Error

Output and errors are written to the PBS job's output and error files, not to standard output/error.

The `pbs_tmsh` command writes a diagnostic message to the PBS job's error file for each error occurrence.

## 2.37.6 Exit Status

The `pbs_tmsh` program exits with the exit status of the remote command or with `255` if an error occurred. This is because `ssh` works this way.

## 2.37.7 See Also

The PBS Professional Administrator's Guide, ["pbs\\_attach" on page 58](#), ["Task Management API", on page 93 of the PBS Professional Programmer's Guide](#)

## 2.38 pbs\_topologyinfo

Reports topological information

### 2.38.1 Synopsis

```
pbs_topologyinfo -a [ [ (-l [<vnode name(s)> ] ) | (-s [<vnode name(s)>] ) ] ]  
pbs_topologyinfo -auv  
pbs_topologyinfo -l [<vnode name> [<vnode name> ...] ]  
pbs_topologyinfo -s [<vnode name> [<vnode name> ...] ]  
pbs_topologyinfo -h
```

### 2.38.2 Description

The `pbs_topologyinfo` command reports licensing and/or topological information for one or more vnodes. This information is used for licensing purposes. To use the command, you must specify what kind of topological information you want. The command reports only the requested information.

This command must be run on the server host.

#### 2.38.2.1 Usage

```
pbs_topologyinfo -au reports number of Altair Unit licenses needed for all vnodes.  
pbs_topologyinfo -auv reports number of cores, ngpus and Altair Unit licenses needed for all vnodes.  
pbs_topologyinfo -al reports number of node licenses needed for all vnodes.  
pbs_topologyinfo -l <vnode name> reports number of node licenses needed for named vnode.  
pbs_topologyinfo -as reports socket counts for all vnodes that have reported sockets.  
pbs_topologyinfo -s <vnode name> reports socket count for named vnode.
```

#### 2.38.2.2 Prerequisites

Before you use this command, the server and MoMs must be configured so that they can contact each other, and must have been run.

#### 2.38.2.3 Required Privilege for `pbs_topologyinfo`

This command can be run only by root or Admin on Windows.

### 2.38.3 Options for `pbs_topologyinfo`

**-a, --all**

Reports requested topological information for all vnodes. When this option is used alone, the command does not report any information.

**-h, --help**

Prints usage and exits.

**-l, --license [<vnode name(s)>]**

Reports number of node licenses required. If you specify *vnode name(s)*, the command reports node licenses needed for the specified vnode(s) only.

**-s, --sockets [<vnode name(s)>]**

Reports derived socket counts. If you specify *vnode name(s)*, the command reports socket count information for the specified vnode(s) only.

**-u, --units**

Requires the **-a** option. Reports number of Altair Unit licenses needed for all vnodes. When used with **-v** option, reports number of cores, ngpus and Altair Unit licenses needed for all vnodes

**-v, --verbose**

Verbose mode. For use with the **-u** option. When used with the **-u** (and **-a**, which is required) options, reports number of cores, ngpus and Altair Unit licenses needed for all vnodes

**(no options)**

Does not report any information.

## 2.38.4 Errors

If you specify an invalid vnode name, the command prints a message to standard error.

## 2.38.5 Operands

**vnode name [<vnode name> ...]**

Name(s) of vnode(s) about which to report.

## 2.38.6 Exit Status

0

Success

1

Any error following successful command line processing

## 2.38.7 Standard Error

If an invalid vnode name is specified, a message is printed to standard error.

## 2.38.8 See Also

The PBS Professional Administrator's Guide

## 2.39 pbs\_update\_certs

Updates, generates, or verifies existence of TLS certificates for PBS.

### 2.39.1 Synopsis

*pbs\_update\_certs*

*pbs\_update\_certs [-r]*

*pbs\_update\_certs [<TLS certificate directory>]*

### 2.39.2 Description

You can use this command to:

- check whether PBS has certificates in `$PBS_HOME/certs`, and if not, generate certificates and put them in that directory
- generate new certificates for PBS and put them in `$PBS_HOME/certs`
- update PBS certificates with ones you have created by hand, and re-encrypt the DB password

### 2.39.3 Usage

- To check whether TLS certificates are present in `$PBS_HOME/certs`, and if not, generate certificates and put them in that directory:

```
pbs_update_certs
```

- To generate new certificates for PBS and put them in `$PBS_HOME/certs`:

```
pbs_update_certs -r
```

- To update PBS certificates with ones you have created by hand, and re-encrypt the DB password:

```
pbs_update_certs <TLS certificate directory>
```

This does the following:

- Copies the certificates to `$PBS_HOME/certs`
- Invokes `pbs_ds_password -t` to re-encrypt the DB password

The command is available only at the server.

For updating the server's certificates, we recommend shutting down the server before running this command.

When updating MoM certificates, copy the certificates to `PBS_HOME/certs/` on the MoM host.

You must be root to run this command.

#### 2.39.3.1 Using this Command During Installation

At installation, `pbs_postinstall` invokes this utility this way:

```
pbs_update_certs $PBS_CERT_DIR
```

If the environment variable `$PBS_CERT_DIR` is defined and contains TLS certificates, `pbs_update_certs` uses the existing TLS certificates in `$PBS_CERT_DIR` and does not generate new certificates. If `$PBS_CERT_DIR` is not defined and/or does not contain TLS certificates, `pbs_update_certs` generates new certificates and puts them in `$PBS_HOME/certs`.

---

## 2.39.4 Options and Arguments

**-r, --regenerate**

Generates a fresh pair of certificates and installs them in `$PBS_HOME/certs`.

**<TLS certificate directory>**

Path to directory containing TLS certificate files `cert.pem`, `key.pem`, and `pbs_ca.pem`. These files are copied to `$PBS_HOME/certs`. The `pbs_update_certs` command invokes `pbs_ds_password -t` to re-encrypt the DB password.

## 2.40 pbs\_wish

**Deprecated.** TK window shell with TCL-wrapped PBS API

### 2.40.1 Synopsis

*pbs\_wish*

*pbs\_wish --version*

### 2.40.2 Description

The `pbs_wish` command is a version of the TK window shell which includes wrapped versions of the PBS external API. The PBS TCL API is documented in ["TCL/tk Interface" on page 105 in the PBS Professional Programmer's Guide](#).

### 2.40.3 Options

`--version`

The `pbs_wish` command returns its PBS version information and exits. This option can only be used alone.

### 2.40.4 Standard Error

The `pbs_wish` command writes a diagnostic message to standard error for each error occurrence.

### 2.40.5 See Also

The PBS Professional Administrator's Guide, ["pbs\\_tclsh" on page 125](#)



---

## 2.41 printjob

Prints job information

### 2.41.1 Synopsis

```
printjob [ -a | -s ] <job ID>
printjob [ -a ] <file path> [<file path>...]
printjob --version
```

### 2.41.2 Description

Prints job information. This command is mainly useful for troubleshooting, as during normal operation, the ["qstat"](#) command is the preferred method for displaying job-specific data and attributes. The server and MoM do not have to be running to execute this command.

#### 2.41.2.1 Usage

For a running job, you can run this command at any host using a job ID, and you can run this command at any execution host where the job is running using a .JB file path.

For a finished job, if job history is enabled, you can run this command at the server using the job ID.

When querying the server, you must use the job ID, and the data service must be running.

Results will vary depending on whether you use the job ID or a .JB file, and on which execution host you query with a .JB file.

#### 2.41.2.2 Permissions

In order to execute `printjob`, you must have root or Windows Administrator privilege.

### 2.41.3 Options to printjob

(no options>

Prints all job data including job attributes.

-a

Suppresses the printing of job attributes. Cannot be used with -s option.

-s

Prints out the job script only. Can be used at server or primary execution host. Cannot be used with -a option. Must be used with a job ID.

--version

The `printjob` command returns its PBS version information and exits. This option can only be used alone.

## 2.41.4 Operands for `printjob`

### file path

The `printjob` command accepts one or more *file path* operands at the execution host. Files are found in `PBS_HOME/mom_priv/jobs/` on the primary execution host. File path must include full path to file. Cannot be used with `-s` option.

### job ID

The `printjob` command accepts a *job ID* at the server host. The format is described in ["Job ID, Job Identifier" on page 359](#). Data service must be running.

## 2.41.5 Standard Error

The `printjob` command writes a diagnostic message to standard error for each error occurrence.

## 2.41.6 Exit Status

### Zero

Upon successful processing of all operands presented

### Greater than zero

If the `printjob` command fails to process any operand

## 2.41.7 See Also

The PBS Professional Administrator's Guide, ["qstat" on page 205](#)

## 2.42 qalter

Alters a PBS job

### 2.42.1 Synopsis

```
qalter [-a <date and time>] [-A <account string>] [-c <checkpoint spec>] [-e <error path>] [-h <hold list>] [-j
    <join>] [-k <discard>] [-l <resource list>] [-m <mail events>] [-M <user list>] [-N <name>] [-o <output path>]
    [-p <priority>] [-P <project>] [-r <y|n>] [-R <remove options>] [-S <path list>] [-u <user list>] [-W
    <additional attributes>] <job ID> [<job ID> ...]
```

```
qalter --version
```

### 2.42.2 Description

The `qalter` command is used to alter one or more PBS batch jobs. Each of certain job attributes can be modified using the `qalter` option for that attribute. You can alter a job or a job array, but not a subjob or range of subjobs.

#### 2.42.2.1 Required Privilege

A non-privileged user can alter their own jobs, whether they are queued or running. An Operator or Manager can alter any job, whether it is queued or running.

A non-privileged user can only lower resource requests. An Operator or Manager can raise or lower resource requests.

#### 2.42.2.2 Modifying Resources and Job Placement

A Manager or Operator may lower or raise requested resource limits, except for per-process limits such as `pcput` and `pmem`, because these are set when the process starts, and enforced by the kernel. A non-privileged user can only lower resource requests.

The `qalter` command cannot be used by a non-privileged user to alter a custom resource which has been created to be invisible or read-only for users.

If a job is running, the only resources that can be modified are `cput`, `walltime`, `min_walltime`, and `max_walltime`.

If a job is queued, any resource mentioned in the options to the `qalter` command can be modified, but requested modifications must fit within the limits set at the server and queue for the amount of each resource allocated for queued jobs. If a requested modification does not fit within these limits, the modification is rejected.

A job's resource request must fit within the queue's and server's resource run limits. If a modification to a resource exceeds the amount of the resource allowed by the queue or server to be used by running jobs, the job is never run.

Requesting resources includes setting limits on resource usage and controlling how the job is placed on vnodes.

See [Chapter 5, "List of Built-in Resources", on page 265](#).

##### 2.42.2.2.i Syntax for Modifying Resources and Job Placement

Resources are modified by using the `-l` option, either in chunks inside of selection statements, or in job-wide requests using `<resource name>=<value>` pairs. The selection statement is of the form:

```
-l select=[<N>:]<chunk>[+ [<N>:]<chunk> ...]
```

where `N` specifies how many of that chunk, and a `chunk` is of the form:

```
<resource name>=<value>[:<resource name>=<value> ...]
```

Job-wide `<resource name>=<value>` requests are of the form:

```
-l <resource name>=<value>[,<resource name>=<value> ...]
```

### 2.42.2.2.ii The Place Statement

You choose how your chunks are placed using the *place statement*. The *place statement* can contain the following elements, in any order:

```
-l place=[<arrangement>][[: <sharing> ][: <grouping>]
```

where

*arrangement*

Whether this chunk is willing to share this vnode or host with other chunks from the same job. One of *free* | *pack* | *scatter* | *vscatter*

*sharing*

Whether this this chunk is willing to share this vnode or host with other jobs. One of *excl* | *shared* | *exclhost*

*grouping*

Whether the chunks from this job should be placed on vnodes that all have the same value for a resource. Can have only one instance of *group=<resource name>*

*free*

Place job on any vnode(s).

*pack*

All chunks are taken from one host.

*scatter*

Only one chunk with any MPI processes is taken from a host. A chunk with no MPI processes may be taken from the same vnode as another chunk.

*vscatter*

Only one chunk is taken from any vnode. Each chunk must fit on a vnode.

*excl*

Only this job uses the vnodes chosen.

*shared*

This job can share the vnodes chosen.

*exclhost*

The entire host is allocated to the job.

*group=<resource name>*

Chunks are grouped according to a resource. All vnodes in the group must have a common value for *resource*, which can be either the built-in resource *host* or a custom vnode-level resource. The *resource name* must be a string or a string array.

The *place statement* cannot begin with a colon. Colons are delimiters; use them only to separate parts of a place statement, unless they are quoted inside resource values.

Note that vnodes can have *sharing* attributes that override job placement requests. See [section 6.10, “Vnode Attributes”](#), on page 325.

For more on resources, resource requests, usage limits, and job placement, see [“Using PBS Resources” on page 229 in the PBS Professional Administrator’s Guide](#) and [“Allocating Resources & Placing Jobs”](#), on page 51 of the [PBS Professional User’s Guide](#).

### 2.42.2.3 Modifying Attributes

The user alters job attributes via options to the `qalter` command. Each `qalter` option changes a job attribute.

The behavior of the `qalter` command may be affected by any site hooks. Site hooks can modify the job's attributes, change its routing, etc.

To modify the `max_run_subjobs` attribute, use `qalter -Wmax_run_subjobs=<new value> <job ID>`.

### 2.42.2.4 Caveats and Restrictions for Altering Jobs

- When you lengthen the `walltime` of a running job, make sure that the new `walltime` will not interfere with any existing reservations etc.
- If any of the modifications to a job fails, none of the job's attributes is modified.
- A job that is in the process of provisioning cannot be altered.

## 2.42.3 Options to `qalter`

### -a <date and time>

Changes the point in time after which the job is eligible for execution. Given in pairs of digits. Sets job's `Execution_Time` attribute to *date and time*.

Format: *Datetime*

Each portion of the date defaults to the current date, as long as the next-smaller portion is in the future. For example, if today is the 3rd of the month and the specified day *DD* is the 5th, the month *MM* is set to the current month.

If a specified portion has already passed, the next-larger portion is set to one after the current date. For example, if the day *DD* is not specified, but the hour *hh* is specified to be 10:00 a.m. and the current time is 11:00 a.m., the day *DD* is set to tomorrow.

The job's `Execution_Time` attribute can be altered after the job has begun execution, in which case it will not take effect until the job is rerun.

### -A <account string>

Replaces the accounting string associated with the job. Used for labeling accounting data. Sets job's `Account_Name` attribute to *account string*. This attribute cannot be altered once the job has begun execution.

Format: *String*

### -c <checkpoint spec>

Changes when the job will be checkpointed. Sets job's `Checkpoint` attribute. An `$action` script is required to checkpoint the job. This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

The argument *checkpoint spec* can take one of the following values:

**c**

Checkpoint at intervals, measured in CPU time, set on job's execution queue. If no interval set at queue, job is not checkpointed.

**c=<minutes of CPU time>**

Checkpoint at intervals of specified number of minutes of job CPU time. This value must be greater than zero. If interval specified is less than that set on job's execution queue, queue's interval is used.

Format: *Integer*

**w**

Checkpoint at intervals, measured in walltime, set on job's execution queue. If no interval set at queue, job is not checkpointed.

**w=<minutes of walltime>**

Checkpoint at intervals of the specified number of minutes of job walltime. This value must be greater than zero. If the interval specified is less than that set on the job's execution queue, the queue's interval is used.

Format: *Integer*

**n**

No checkpointing.

**s**

Checkpoint only when the server is shut down.

**u**

Unset. Defaults to behavior when interval argument is set to *s*.

Default: *u*

Format: *String*

**-e <error path>**

Replaces the path to be used for the job's standard error stream. Sets job's **Error\_Path** attribute to *error path*. Overridden by **-k** option.

Format: [*<hostname>*:]*<path>*

The *error path* is interpreted as follows:

*path*

If *path* is relative, it is taken to be relative to the current working directory of the **qalter** command, where it is executing on the current host.

If *path* is absolute, it is taken to be an absolute path on the current host where the **qalter** command is executing.

*hostname:path*

If *path* is relative, it is taken to be relative to the user's home directory on the host named *hostname*.

If *path* is absolute, it is the absolute path on the host named *hostname*.

If *path* does not include a filename, the default filename is *<job ID>.ER*

If the **-e** option is not specified, PBS writes standard error to the default filename, which has this form:

*<job name>.e<sequence number>*

This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

If you use a UNC path, the hostname is optional. If you use a non-UNC path, the hostname is required.

**-h <hold list>**

Updates the job's hold list. Adds *hold list* to the job's `Hold_Types` attribute. The *hold list* is a string of one or more characters. The following table shows the holds and the privilege required to set each:

**Table 2-9: Hold Types**

| Hold Type | Meaning             | Who Can Set  |
|-----------|---------------------|--|
| <i>u</i>  | <i>User</i>         | <i>Job owner, Operator, Manager, administrator, root</i> |
| <i>o</i>  | <i>Other</i>        | <i>Operator, Manager, administrator, root</i>            |
| <i>s</i>  | <i>System</i>       | <i>Manager, administrator, root, PBS (dependency)</i>    |
| <i>n</i>  | <i>None</i>         | <i>Job owner, Operator, Manager, administrator, root</i> |
| <i>p</i>  | <i>Bad password</i> | <i>Administrator, root</i>                               |

This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

**-j <join>**

Changes whether and how to join the job's standard error and standard output streams. Sets job's `Join_Path` attribute to *join*.

This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

Default: *n*; not merged

The *join* argument can take the following values:

**Table 2-10: Join Path Options**

| Value     | Meaning   |
|-----------|---|
| <i>oe</i> | Standard error and standard output are merged into standard output. |
| <i>eo</i> | Standard error and standard output are merged into standard error.  |
| <i>n</i>  | Standard error and standard output are not merged.                  |

**-k <discard>**

Specifies whether and which of the standard output and standard error streams is left behind on the execution host, or written to their final destination. Sets the job's `Keep_Files` attribute to *discard*.

**k {e | o | eo | oe | n}**

For the *e*, *o*, *eo*, *oe*, or *n* suboptions, overrides *-o* and *-e* options.

kd {e | o | eo | oe}

When used with the `-d` suboption, specifies that output and/or error files are written directly to the final destination. Requires `-o <output path>` and/or `-e <error path>`.

Default: *n*; neither is retained, and files are not written directly to final destinations.

In the case where output and/or error is retained on the execution host in a job-specific staging and execution directory created by PBS, these files are deleted when PBS deletes the directory.

The *discard* argument can take the following values:

**Table 2-11: Sub-options to discard Option**

| Suboption                  | Meaning  |
|----------------------------|--|
| <i>e</i>                   | The standard error stream is retained on the execution host, in the job's staging and execution directory. The filename is <code>&lt;job name&gt;.e&lt;sequence number&gt;</code>                                  |
| <i>o</i>                   | The standard output stream is retained on the execution host, in the job's staging and execution directory. The filename is <code>&lt;job name&gt;.o&lt;sequence number&gt;</code>                                 |
| <i>eo, oe</i>              | Both standard output and standard error streams are retained on the execution host, in the job's staging and execution directory.  |
| <i>d&lt;e and/or o&gt;</i> | Output and/or error are written directly to their final destination. Overrides action of leaving files on execution host. Requires <code>-o &lt;output path&gt;</code> and/or <code>-e &lt;error path&gt;</code> . |
| <i>n</i>                   | Neither stream is retained.  |

#### **-l <resource list>**

Allows the user to change requested resources and job placement. Sets job's `Resource_list` attribute to *resource list*. Uses resource request syntax. Requesting a resource places a limit on its usage. Users without manager or operator privilege cannot alter a custom resource which was created to be invisible or read-only for users. For syntax, see [section 2.42.2.2.i, "Syntax for Modifying Resources and Job Placement", on page 135](#).

If a requested modification to a resource would exceed the server's or the job queue's limits, the resource request is rejected. Which resources can be altered is system-dependent.

If the job was submitted with an explicit `"-l select="`, vnode-level resources must be qaltered using the `"-l select="` form. In this case a vnode-level resource *resource* cannot be qaltered with the `"-l <resource name>"` form.

The place statement cannot begin with a colon.

Examples:

1. Submit the job:

```
% qsub -l select=1:ncpus=2:mem=512mb jobscript
Job's ID is 230
```

2. qalter the job using `"-l <resource name>"` form:

```
% qalter -l ncpus=4 230
Error reported by qalter:
```

```
qalter: Resource must only appear in "select" specification when select is used: ncpus 230
```

3. qalter the job using the `"-l select="` form:

```
% qalter -l select=1:ncpus=4:mem=512mb 230
```



No error reported by `qalter`:

%

For more on resource requests, usage limits and job placement, see ["Allocating Resources & Placing Jobs", on page 51 of the PBS Professional User's Guide](#).

### **-m <mail events>**

Changes the set of conditions under which mail about the job is sent. Sets job's `Mail_Points` attribute to *mail events*. The *mail events* argument can be one of the following:

- The single character "*n*"
- Any combination of "*a*", "*b*", and "*e*", with optional "*j*"

The following table lists the sub-options to the `-m` option:

**Table 2-12: Sub-options to m Option**

| Suboption | Meaning  |
|-----------|--|
| <i>n</i>  | No mail is sent.   |
| <i>a</i>  | Mail is sent when the job is aborted by PBS.   |
| <i>b</i>  | Mail is sent when the job begins execution.  |
| <i>e</i>  | Mail is sent when the job terminates.  |
| <i>j</i>  | Mail is sent for subjobs. Must be combined with one or more of <i>a</i> , <i>b</i> , or <i>e</i> options |

Can be used with job arrays but not subjobs.

Format: *String*

Syntax: *n* | [*j*](*one or more of a, b, e*)

Example: `-m ja`

Default value: "*a*"

### **-M <user list>**

Alters list of users to whom mail about the job is sent. Sets job's `Mail_Users` attribute to *user list*.

Format: `<username>[@<hostname>][,<username>[@<hostname>],...]`

Default: Job owner.

### **-N <name>**

Renames the job. Sets job's `Job_Name` attribute to *name*.

Format: *Job Name*. See ["Job Name, Job Array Name" on page 359](#).

Default: if a script is used to submit the job, the job's name is the name of the script. If no script is used, the job's name is "*STDIN*".

### **-o <output path>**

Alters path to be used for the job's standard output stream. Sets job's `Output_Path` attribute to *output path*.

Overridden by `-k` option.

Format: [*<hostname>:*]*<path>*

The *output path* is interpreted as follows:

*path*

If *path* is relative, it is taken to be relative to the current working directory of the command, where it is executing on the current host.

If *path* is absolute, it is taken to be an absolute path on the current host where the command is executing.

*<hostname>:<path>*

If *path* is relative, it is taken to be relative to the user's home directory on the host named *hostname*.

If *path* is absolute, it is the absolute path on the host named *hostname*.

If *path* does not include a filename, the default filename is:

*<job ID>.OU*

If the *-o* option is not specified, PBS writes standard output to the default filename, which has this form:

*<job name>.o<sequence number>*

This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

If you use a UNC path, the hostname is optional. If you use a non-UNC path, the hostname is required.

### **-p <priority>**

Alters priority of the job. Sets job's **Priority** attribute to *priority*.

This attribute can be altered after the job has begun execution, in which case the new value will not take effect until the job is rerun.

Format: *Host-dependent integer*

Range: [-1024, +1023] inclusive

Default: *zero*

### **-P <project>**

Specifies a project for the job. Sets job's **project** attribute to specified value.

Format: *Project Name*; see ["Project Name" on page 361](#)

Default: *"\_pbs\_project\_default"*

### **-r <y|n>**

Changes whether the job is rerunnable. Sets job's **Rerunnable** attribute to the argument. Does not affect how job is handled when the job is unable to begin execution.

See ["qrerun" on page 186](#).

Format: Single character, "y" or "n".

y

Job is rerunnable.

n

Job is not rerunnable.

Default: "y".

Interactive jobs are not rerunnable. Job arrays are always rerunnable.

**-R <remove options>**

Changes whether standard output and/or standard error files are automatically removed upon job completion.

Sets the job's `Remove_Files` attribute to *remove options*. Overrides default path names for these streams.

Overrides `-o` and `-e` options.

This attribute cannot be altered once the job has begun execution.

Default: unset; neither is removed

The *remove options* argument can take the following values:

**Table 2-13: discard Argument Values**

| Option        | Meaning   |
|---------------|---|
| <i>e</i>      | The standard error stream is removed (deleted) upon job completion                        |
| <i>o</i>      | The standard output stream is removed (deleted) upon job completion                       |
| <i>eo, oe</i> | Both standard output and standard error streams are removed (deleted) upon job completion |
| <i>unset</i>  | Neither stream is removed   |

**-S <path list>**

Specifies the interpreter or shell path for the job script. Sets job's `Shell_Path_List` attribute to *path list*.

The *path list* argument is the full path to the interpreter or shell including the executable name.

Only one path may be specified without a hostname. Only one path may be specified per named host. The path selected is the one whose hostname is that of the server on which the job resides.

This attribute can be altered after the job has begun execution, but in this case the new value will not take effect until the job is rerun.

Format:

`<path>[@<hostname>][,<path>@<hostname> ...]`

If the path contains spaces, it must be quoted. For example:

```
qsub -S "C:\Program Files\PBS Pro\bin\pbs_python.exe" <script name>
```

Default: user's login shell on execution node

Example of using `bash` via a directive:

```
#PBS -S /bin/bash@mars,/usr/bin/bash@jupiter
```

Example of running a Python script from the command line on Linux:

```
qsub -S $PBS_EXEC/bin/pbs_python <script name>
```

Example of running a Python script from the command line on Windows:

```
qsub -S %PBS_EXEC%\bin\pbs_python.exe <script name>
```

**-u <user list>**

Alters list of usernames. Job will run under a username from this list. Sets job's `User_List` attribute to *user list*.

Only one username may be specified without a hostname. Only one username may be specified per named host.

The server on which the job resides will select first the username whose hostname is the same as the server name. Failing that, the next selection will be the username with no specified hostname. The usernames on the server and execution hosts must be the same. The job owner must have authorization to run as the specified user.

This attribute cannot be altered once the job has begun execution.

Format: `<username>[@<hostname>][,<username>@<hostname> ...]`

Default: Job owner (username on submit host)

### -W <additional attributes>

Each sub-option to the -W option allows you to change a specific job attribute.

Format: `-W <attribute name> = <attribute value>[,<attribute name>=<attribute value>...]`

If white space occurs within the *additional attributes* argument, or the equal sign ("=") occurs within an *attribute value* string, that argument or string must be enclosed in single or double quotes. PBS supports setting the following attributes via the -W option:

#### depend=<dependency list>

Defines dependencies between this and other jobs. Sets the job's `depend` attribute to *dependency list*. The *dependency list* has the form:

`<type>:<arg list>[,<type>:<arg list> ...]`

where except for the *on* type, the *<arg list>* is one or more PBS job IDs in the form:

`<job ID>[:<job ID> ...]`

The types and their argument lists can be:

#### after: <arg list>

This job may be scheduled for execution at any point after all jobs in *arg list* have started execution.

#### afterok: <arg list>

This job may be scheduled for execution only after all jobs in *arg list* have terminated with no errors.

See [section 2.42.6.1, “Warning About Exit Status with csh”, on page 147](#).

#### afternotok: <arg list>

This job may be scheduled for execution only after all jobs in *arg list* have terminated with errors. See

[section 2.42.6.1, “Warning About Exit Status with csh”, on page 147](#).

#### afterany: <arg list>

This job may be scheduled for execution after all jobs in *arg list* have terminated, with or without errors. This job will not run if a job in the *arg list* was deleted without ever having been run.

#### before: <arg list>

Jobs in *arg list* may begin execution once this job has begun execution.

#### beforeok: <arg list>

Jobs in *arg list* may begin execution once this job terminates without errors. See [section 2.42.6.1,](#)

[“Warning About Exit Status with csh”, on page 147](#).

#### beforenotok: <arg list>

If this job terminates execution with errors, jobs in *arg list* may begin. See [section 2.42.6.1, “Warning About Exit Status with csh”, on page 147](#).

#### beforeany: <arg list>

Jobs in *arg list* may begin execution once this job terminates execution, with or without errors.

#### on: <count>

This job may be scheduled for execution after *count* dependencies on other jobs have been satisfied.

This type is used in conjunction with one of the *before* types listed. *count* is an integer greater than 0.

#### runone:<job ID>

Puts the current job and the job with *job ID* in a set of jobs out of which PBS will eventually run just one. To add a job to a set, specify the job ID of another job already in the set.

Restrictions:

Job IDs in the *arg list* of *before* types must have been submitted with a type of *on*.

To use the *before* types, the user must have the authority to alter the jobs in *arg list*. Otherwise, the dependency is rejected and the new job aborted.

Error processing of the existence, state, or condition of the job on which the newly-submitted job depends is performed after the job is queued. If an error is detected, the new job is deleted by the server. Mail is sent to the job submitter stating the error.

Dependency examples:

```
qalter -W depend = afterok:123.host1.domain.com /tmp/script
```

```
qalter -W depend= before:234.host1.com:235.host1.com /tmp/script
```

**group\_list=<group list>**

Alters list of group names. Job will run under a group name from this list. Sets job's `group_List` attribute to *group list*.

Only one group name may be specified without a hostname. Only one group name may be specified per named host. The server on which the job resides will select first the group name whose hostname is the same as the server name. Failing that, the next selection is the group name with no specified hostname. The group names on the server and execution hosts must be the same.

Format: <group>[@<hostname>][,<group>@<hostname> ...]

Default: no default

**release\_nodes\_on\_stageout=<value>**

When set to *True*, all of the job's vnodes not on the primary execution host are released when stageout begins.

When cgroups is enabled and this is used with some but not all vnodes from one MoM, resources on those vnodes that are part of a cgroup are not released until the entire cgroup is released.

The job's `stageout` attribute must be set for the `release_nodes_on_stageout` attribute to take effect.

Format: *Boolean*

Default: *False*

**run\_count=<count>**

Sets the number of times the server thinks it has run the job. Sets the job's `run_count` attribute to *count*. Can be altered while job is running. Job is held when the value of this attribute goes over 20.

Format: Integer greater than or equal to zero

**sandbox=<sandbox spec>**

Changes which directory PBS uses for the job's staging and execution. Sets job's `sandbox` attribute to the value of *sandbox spec*.

Format: *String*

Allowed values for *sandbox spec*:

**PRIVATE**

PBS creates a job-specific directory for staging and execution.

**HOME** or **unset**

PBS uses the user's home directory for staging and execution.

**stagein=<path list>**

**stageout=<path list>**

Changes files or directories to be staged in before execution or staged out after execution is complete. Sets the job's `stagein` and `stageout` attributes to the specified *path lists*. On completion of the job, all staged-in and staged-out files and directories are removed from the execution host(s). A *path list* has the form:

<filespec>[,<filespec>]

where *filespec* is

*<execution path>@<hostname>:<storage path>*

regardless of the direction of the copy. The *execution path* is the name of the file or directory on the primary execution host. It can be relative to the staging and execution directory on the execution host, or it can be an absolute path.

The "@" character separates *execution path* from *storage path*.

The *storage path* is the path on *hostname*. The name can be relative to the staging and execution directory on the primary execution host, or it can be an absolute path.

If *path list* has more than one *filespec*, i.e. it contains commas, it must be enclosed in double quotes.

If you use a UNC path, the hostname is optional. If you use a non-UNC path, the hostname is required.

**umask=<mask value>**

Alters the umask with which the job is started. Controls umask of job's standard output and standard error. Sets job's umask attribute to *mask value*.

Format: one to four digits; typically two

The following example allows group and world read of the job's output and error:

```
-W umask=33
```

Default: *system default*

**--version**

The `qalter` command returns its PBS version information and exits. This option can only be used alone.

## 2.42.4 Operands

The `qalter` command accepts a *job ID* list as its operand. The *job ID* list is a space-separated list of one or more job IDs for normal jobs or array jobs.

Subjobs and ranges of subjobs are not alterable.

Job IDs have the form:

```
<sequence number>[.<server name>][@<server name>]
```

```
<sequence number>[[.<server name>][@<server name>]
```

Note that some shells require that you enclose a job array ID in double quotes.

## 2.42.5 Standard Error

The `qalter` command writes a diagnostic message to standard error for each error occurrence.

## 2.42.6 Exit Status

**Zero**

Upon successful processing of input

**Greater than zero**

Upon failure

---

### 2.42.6.1 Warning About Exit Status with `cs`

If a job is run in `cs` and a `.logout` file exists in the home directory in which the job executes, the exit status of the job is that of the `.logout` script, not the job script. This may impact any inter-job dependencies.

### 2.42.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["Job Attributes" on page 332](#), [Chapter 5, "List of Built-in Resources", on page 265](#)

## 2.43 qdel

Deletes PBS jobs

### 2.43.1 Synopsis

```
qdel [ -x ] [ -Wforce | -Wsuppress_email=<N> ] <job ID> [<job ID> ...]  
qdel --version
```

### 2.43.2 Description

The `qdel` command deletes jobs in the order given, whether they are at the local server or at a remote server.

#### 2.43.2.1 Usage

The `qdel` command is used without options to delete queued, running, held, or suspended jobs, while the `-x` option gives it the additional capacity to delete finished or moved jobs. With the `-x` option, this command can be used on finished and moved jobs, in addition to queued, running, held, or suspended jobs.

When this command is used without the `-x` option, if job history is enabled, the deleted job's history is retained. The `-x` option is used to additionally remove the history of the job being deleted.

If someone other than the job's owner deletes the job, mail is sent to the job's owner, or to a list of mail recipients if specified during `qsub`. See ["qsub" on page 221](#).

If the job is in the process of provisioning, it can be deleted only by using the `-W force` option.

#### 2.43.2.2 How Behavior of `qdel` Command Can Be Affected

The server's `default_qdel_arguments` attribute may affect the behavior of the `qdel` command. This attribute is settable by the administrator via the `qmgr` command. The attribute may be set to `"-Wsuppress_email=<N>"`. The server attribute is overridden by command-line arguments. See [section 6.6, "Server Attributes", on page 285](#).

#### 2.43.2.3 Sequence of Events

1. The job's running processes are killed.
2. The epilogue runs.
3. Files that were staged in are staged out. This includes standard out (.o) and standard error (.e) files.
4. Files that were staged in or out are deleted.
5. The job's temp directory is removed.
6. The job is removed from the MoM(s) and the server.

#### 2.43.2.4 Required Privilege

A PBS job may be deleted by its owner, an Operator, or the administrator. The MoM deletes a PBS job by sending a SIGTERM signal, then, if there are remaining processes, a SIGKILL signal.



### 2.43.3 Options to `qdel`

(no options)

Can delete queued, running, held, or suspended jobs. Does not delete job history for specified job(s).

**-W force**

Deletes the job whether or not the job's execution host is reachable. Deletes the job whether or not the job is in the process of provisioning. Cannot be used with the `-Wsuppress_email` option.

If the server can contact the MoM, this option is ignored; the server allows the job to be deleted normally. If the server cannot contact the MoM or the job is in the *E* state, the server deletes its information about the job.

**-Wsuppress\_email=<N>**

Sets limit on number of emails sent when deleting multiple jobs or subjobs.

- If  $N \geq 1$  and  $N$  or more *job IDs* are given,  $N$  emails are sent.
- If  $N \geq 1$  and less than  $N$  job identifiers are given, the number of emails is the same as the number of jobs.
- If  $N = 0$ , this option is ignored.
- If  $N = -1$ , no mail is sent.

Note that there is no space between "w" and "suppress\_email".

The  $N$  argument is an integer.

Cannot be used with `-Wforce` option.

**-X**

Can delete running, queued, suspended, held, finished, or moved jobs. Deletes job history for the specified job(s).

**--version**

The `qdel` command returns its PBS version information and exits. This option can only be used alone.

### 2.43.4 Operands

The `qdel` command accepts one or more space-separated *job ID* operands. These operands can be job identifiers, job array identifiers, subjob identifiers, or subjob range identifiers.

Job IDs have the form:

```
<sequence number>[.<server name>][@<server name>]
```

Job arrays have the form:

```
<sequence number>[[.<server name>][@<server name>]
```

Subjobs have the form:

```
<sequence number>[<index>][.<server name>][@<server name>]
```

Ranges of subjobs have the form:

```
<sequence number>[<first>-<last>][.<server name>][@<server name>]
```

Job array identifiers must be enclosed in double quotes for some shells.

### 2.43.5 Standard Error

The `qdel` command writes a diagnostic message to standard error for each error occurrence.

## 2.43.6 Exit Status

Zero

Upon successful processing of input

Greater than zero

Upon error

## 2.43.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide

## 2.44 qdisable

Prevents a queue from accepting jobs

### 2.44.1 Synopsis

*qdisable* <destination> [<destination> ...]

*qdisable* --version

### 2.44.2 Description

The `qdisable` command prevents a queue from accepting batch jobs. Sets the value of the queue's `enabled` attribute to *False*. If the command is accepted, the queue no longer accepts Queue Job requests. Jobs already in the queue continue to be processed. You can use this to drain a queue of jobs.

#### 2.44.2.1 Required Permission

In order to execute `qdisable`, the user must have PBS Operator or Manager privilege.

### 2.44.3 Options

--version

The `qdisable` command returns its PBS version information and exits. This option can only be used alone.

### 2.44.4 Operands

The `qdisable` command accepts one or more space-separated *destination* operands. The operands take any of the following forms:

<queue name>

Prevents specified queue at default server from accepting jobs.

@<server name>

Prevents all queues at specified server from accepting jobs.

<queue name>@<server name>

Prevents specified queue at specified server from accepting jobs.

To prevent all queues at the default server from accepting jobs, use the `qmgr` command:

```
Qmgr: set queue @default enabled=false
```

### 2.44.5 Standard Error

The `qdisable` command writes a diagnostic message to standard error for each error occurrence.

## 2.44.6 Exit Status

### Zero

Upon successful processing of all the operands

### Greater than zero

If the `qdisable` command fails to process any operand

## 2.44.7 See Also

The PBS Professional Administrator's Guide, ["qmgr" on page 157](#), ["qenable" on page 153](#)

---

## 2.45 qenable

Allows a queue to accept jobs

### 2.45.1 Synopsis

```
qenable <destination> [<destination> ...]  
qenable --version
```

### 2.45.2 Description

The `qenable` command allows a queue to accept batch jobs. Sets the value of the queue's `enabled` attribute to `True`. If the command is accepted, the *destination* accepts Queue Job requests.

#### 2.45.2.1 Required Privilege

In order to execute `qenable`, the user must have PBS Operator or Manager privilege.

### 2.45.3 Options

`--version`

The `qenable` command returns its PBS version information and exits. This option can only be used alone.

### 2.45.4 Operands

The `qenable` command accepts one or more space-separated *destination* operands. The operands take any of the following forms:

`<queue name>`

Allows specified queue at default server to accept jobs.

`@<server name>`

Allows all queues at specified server to accept jobs.

`<queue name>@<server name>`

Allows specified queue at specified server to accept jobs.

To allow all queues at the default server to accept jobs, use the `qmgr` command:

```
Qmgr: set queue @default enabled=true
```

### 2.45.5 Standard Error

The `qenable` command writes a diagnostic message to standard error for each error occurrence.

### 2.45.6 Exit Status

Zero

Upon successful processing of all the operands

Greater than zero

If the `genable` command fails to process any operand

## 2.45.7 See Also

The PBS Professional Administrator's Guide, ["qmgr" on page 157](#), ["qdisable" on page 151](#)

## 2.46 qhold

Holds PBS batch jobs

### 2.46.1 Synopsis

```
qhold [-h <hold list>] <job ID> [<job ID> ...]
```

```
qhold --version
```

### 2.46.2 Description

Places one or more holds on a job. A job that has a hold is not eligible for execution. Can be used on jobs and job arrays, but not on subjobs or ranges of subjobs.

If a job identified by *job ID* is in the queued, held, or waiting states, all that occurs is that the hold type is added to the job. The job is then put into the held state if it resides in an execution queue.

If the job is running, the result of the `qhold` command depends upon whether the job can be checkpointed. The job can be checkpointed if the OS supports checkpointing, or if the application being checkpointed supports checkpointing. See the PBS Professional Administrator's Guide. If the job can be checkpointed, the following happens:

- The job is checkpointed and its execution is interrupted.
- The resources assigned to the job are released.
- The job is placed in the held state in the execution queue.
- The job's `Hold_Types` attribute is set to *u* for *user hold*.

If checkpoint / restart is not supported, `qhold` simply sets the job's `Hold_Types` attribute to *u*. The job continues to execute.

A job's dependency places a *system* hold on the job. When the dependency is satisfied, the *system* hold is removed. If the administrator sets a *system* hold on a job with a dependency, when the dependency is satisfied, the job becomes eligible for execution.

If the job is in the process of provisioning, it cannot be held.

A hold on a job can be released by the [PBS Administrator](#), root, a Manager, an Operator, or the job owner, when the job reaches the time set in its `Execution_Time` attribute, or when a dependency clears. See ["qrls" on page 188](#).

#### 2.46.2.1 Effect of Privilege on Behavior

The following table shows the holds and the privilege required to set each:

**Table 2-14: Hold Types**

| Hold Type | Meaning             | Who Can Set  |
|-----------|---------------------|--|
| <i>u</i>  | <i>User</i>         | <i>Job owner, Operator, Manager, <a href="#">PBS Administrator</a>, root</i> |
| <i>o</i>  | <i>Other</i>        | <i>Operator, Manager, PBS Administrator, root</i>                            |
| <i>s</i>  | <i>System</i>       | <i>Manager, PBS Administrator, root, PBS (dependency)</i>                    |
| <i>n</i>  | <i>No hold</i>      | <i>Job owner, Operator, Manager, PBS Administrator, root</i>                 |
| <i>p</i>  | <i>Bad password</i> | <i>PBS Administrator, root</i>   |

### 2.46.3 Options to `qhold`

(no options)

Same as `-h u`. Applies the *user* hold to the specified job(s).

`-h <hold list>`

Types of holds to be placed on the job(s).

The *hold list* argument is a string consisting of one or more of the letters "u", "o", or "s" in any combination, or one of the letters "n" or "p".

`--version`

The `qhold` command returns its PBS version information and exits. This option can only be used alone.

### 2.46.4 Operands

The `qhold` command can be used on jobs and job arrays, but not on subjobs or ranges of subjobs. The `qhold` command accepts one or more *job IDs* in the form:

`<sequence number>[.<server name>][@<server name>]`

`<sequence number>[[.<server name>][@<server name>]`

Note that some shells require that you enclose a job array identifier in double quotes.

### 2.46.5 Standard Error

The `qhold` command writes a diagnostic message to standard error for each error occurrence.

### 2.46.6 Exit Status

Zero

Upon successful processing of all operands

Greater than zero

If the `qhold` command fails to process any operand

### 2.46.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["qrls" on page 188](#)



## 2.47 qmgr

Administrator's command interface for managing PBS

### 2.47.1 Synopsis

**At shell command line:**

```
qmgr -c '<directive> [-a] [-e] [-n] [-z]'
```

```
qmgr -c 'help [<help option>']
```

```
qmgr <return>
```

```
qmgr --version
```

**In qmgr session:**

```
<directive> [-a] [-e] [-n] [-z]
```

```
help <help option>
```

### 2.47.2 Description

The PBS manager command, `qmgr`, provides a command-line interface to parts of PBS. The `qmgr` command is used to create or delete queues, vnodes, resources, and hooks, to set or change vnode, queue, hook, server, or scheduler attributes and resources, and to view information about hooks, queues, vnodes, resource definitions, the server, and schedulers.

For a list of quick summaries of information about syntax, commands, attributes, operators, names, and values, type "help" or "?" at the `qmgr` prompt. See [section 2.47.11, "Printing Usage Information", on page 178](#).

#### 2.47.2.1 Modes of Operation

- When you type `qmgr -c '<directive>'`, `qmgr` performs its task and then exits.
- When you type `qmgr <return>`, `qmgr` starts a session and presents you with its command line prompt. The `qmgr` command then reads directives etc. from standard input; see [section 2.47.4.1, "Directive Syntax", on page 159](#). You can edit the command line; see [section 2.47.2.4, "Reusing and Editing the qmgr Command Line", on page 158](#).

For a `qmgr` prompt, type:

```
qmgr <return>
```

You will see the `qmgr` prompt:

```
Qmgr:
```

#### 2.47.2.2 Required Privilege

The `qmgr` command requires different levels of privilege depending on the operation to be performed.

All users can list or print attributes except for hook attributes.

PBS Operator or Manager privilege is required in order to set or change vnode, queue, server, or scheduler attributes.

PBS Manager privilege is required in order to create or delete queues, vnodes, and resources.

Under Linux, root privilege is required in order to create hooks, or operate on hooks or the `job_sort_formula` server attribute. Under Windows, this must be done from the installation account.

For domained environments, the installation account must be a local account that is a member of the local Administrators group on the local computer.

---

Users without manager or operator privilege cannot view custom resources or resource definitions which were created to be invisible to users.

### 2.47.2.3 When To Run `qmgr` At Server Host

Run the `qmgr` command at the server host when operating on hooks or on the `job_sort_formula` server attribute.

### 2.47.2.4 Reusing and Editing the `qmgr` Command Line

You can reuse or edit `qmgr` command lines. The `qmgr` command maintains a history of commands entered, up to a maximum of 500. You can use the `'history'` command to see a numbered list of commands, and the `!n` command to execute the line whose number is *n*. You must not put any spaces between the bang ("`!`") and the number. For example, to execute the 123rd command, type the following:

```
!123
```

You can see the last *m* commands by typing `'history m'`. For example, to see the last 6 commands, type the following:

```
history 6
```

You can use the up and down arrows to navigate through the command history list, and the left and right arrows to navigate within a command line. Within a command line, you can use `emacs` commands to move forward and backward, and delete characters.

You can edit the `qmgr` command line using the backspace and delete keys, and you can insert characters anywhere in a command line.

History is maintained across `qmgr` sessions, so that if you start `qmgr`, then exit, then restart it, you can reuse your commands from the previous session. If you exit `qmgr` and then restart it, the command lines are renumbered.

If you enter the same command line more than once in a row, only one occurrence is recorded in the history. If you enter the same command line multiple times, but intersperse other command lines after each line, each occurrence is recorded.

Each user's history is unique to that user on that host.

In the case where an account runs concurrent sessions, the most recent logout of a session overwrites history from previous logouts. For example, if two people are both logged in as root and using `qmgr`, the second person to log out overwrites the history file.

#### 2.47.2.4.i The `qmgr` History File

The `qmgr` command stores and retrieves its history. First, it tries to write its history in the `${HOME}/.pbs_qmgr_history` file. If this file or directory location is not writable, the command stores its history in `$PBS_HOME/spool/.pbs_qmgr_history_<user name>`. If this file is also not writable, the following happens:

- The `qmgr` command prints error messages once at `qmgr` startup
- The `qmgr` command cannot provide history across `qmgr` sessions

## 2.47.3 Options to qmgr

The following table lists the options to qmgr:

**Table 2-15: qmgr Options**

| Option                    | Action  |
|---------------------------|---|
| <return>                  | Starts a qmgr session and presents user with qmgr prompt  |
| -a                        | Aborts qmgr on any syntax errors or any requests rejected by a server.  |
| -c '<directive>'          | Executes a single command ( <i>directive</i> ) and exit qmgr. The <i>directive</i> must be enclosed in single or double quote marks, for example:<br>qmgr -c "print server" |
| -c 'help [<help option>]' | Prints out usage information. See <a href="#">"Printing Usage Information" on page 178</a>  |
| -e                        | Echoes all commands to standard output  |
| -n                        | No commands are executed; syntax checking only is performed   |
| -z                        | No errors are written to standard error   |
| --version                 | The qmgr command returns its PBS version information and exits. This option can only be used alone  |

## 2.47.4 Directives

A qmgr *directive* is a *command* together with the *object(s)* to be operated on, the *attribute(s)* belonging to the object that is to be changed, the *operator*, and the *value(s)* the *attribute(s)* will take. In the case of resources, you can set the *type* and/or *flag(s)*.

### 2.47.4.1 Directive Syntax

A directive is terminated by a newline or a semicolon (";"). Multiple directives may be entered on a single line. A directive may extend across lines by escaping the newline with a backslash ("\").

Comments begin with the "#" character and continue to the end of the line. Comments and blank lines are ignored by qmgr.

#### 2.47.4.1.i Server, Scheduler, Queue, Vnode Directives

Syntax for operating on servers, schedulers, queues, and vnodes:

```
<command> <object type> [<object name(s)>] [<attribute> <operator> <value>[,<attribute> <operator>
<value>,...]]
```

For information about attributes, see [Chapter 6, "Attributes", on page 281](#).

#### 2.47.4.1.ii Resource Directives

Syntax for operating on resources:

```
<command> <resource name> [<resource name> ...] [type = <type>][,flag = <flag(s)>]
```

For information about resources, see ["Using PBS Resources" on page 229 in the PBS Professional Administrator's Guide](#) and [Chapter 5, "List of Built-in Resources", on page 265](#).

### 2.47.4.1.iii Hook-only Directives

The directives here apply only to hooks. Other directives apply to all objects such as queues, resources, hooks, etc.

Syntax for importing and exporting site-defined hooks:

```
"import hook <hook name> application/x-python <content-encoding> (<input file> | -)"
```

```
"export hook <hook name> <content-type> <content-encoding>" > [<output file>]
```

Syntax for importing site-defined hook configuration file:

```
"import hook <hook name> application/x-config <content-encoding> (<input file> | -)"
```

Syntax for importing built-in hook configuration file:

```
"import pbshook <hook name> application/x-config <content-encoding> (<input file> | -)"
```

### 2.47.4.2 Using Directives

You can use a *directive* from the shell command line or from within the `qmgr` session.

- To use a directive from the command line, enclose the command and its arguments in single or double quotes.

```
qmgr -c '<command> <command arguments>'
```

For example, to have `qmgr` print server information and exit:

```
qmgr -c "print server"
```

- To use a directive from within the `qmgr` session, first start `qmgr`:

```
qmgr <return>
```

The `qmgr` session presents a `qmgr` prompt:

```
Qmgr:
```

At the `qmgr` prompt, enter the directive (a command and its arguments). For example, to enter the same "print server" directive:

```
Qmgr: print server
```

### 2.47.4.3 Commands Used in Directives

Commands can be abbreviated to their minimum unambiguous form. Commands apply to all target objects unless explicitly limited. The following table lists the commands, briefly tells what they do, and gives a link to a full description:

**Table 2-16: `qmgr` Commands Used in Directives**

| Command | Abbr | Effect                                      | Description  |
|---------|------|---|--|
| active  | a    | Specifies active objects                    | See <a href="#">section 2.47.6.1, “Making Objects Active”, on page 164</a>   |
| create  | c    | Creates object                              | See <a href="#">section 2.47.6.2, “Creating Objects (Server, Scheduler, Vnode, Queue, Hook)”, on page 165</a>  |
| delete  | d    | Deletes object                              | See <a href="#">section 2.47.6.3, “Deleting Objects”, on page 165</a>  |
| exit    |      | Exits (quits) the <code>qmgr</code> session |  |
| export  | e    | Exports hook or hook configuration file     | See <a href="#">section 2.47.10.6, “Exporting Hooks”, on page 177</a> and <a href="#">section 2.47.10.5.ii, “Exporting Configuration Files”, on page 176</a> |

**Table 2-16: qmgr Commands Used in Directives**

| Command   | Abbr. | Effect                                     | Description  |
|-----------|-------|--|--|
| help or ? | h, ?  | Prints usage to stdout                     | See <a href="#">section 2.47.11, “Printing Usage Information”, on page 178</a>   |
| import    | i     | Imports hook or configuration file         | See <a href="#">section 2.47.10.4, “Importing Hooks”, on page 175</a> or <a href="#">section 2.47.10.5.i, “Importing Configuration Files”, on page 176</a> |
| list      | l     | Lists object attributes and their values   | See <a href="#">section 2.47.8.1, “Listing Objects and Their Attributes”, on page 172</a>  |
| print     | p     | Prints creation and configuration commands | See <a href="#">section 2.47.8.3, “Printing Creation and Configuration Commands”, on page 174</a>  |
| quit      | q     | Quits (exits) the qmgr session             |  |
| set       | s     | Sets value of attribute                    | See <a href="#">section 2.47.7.1, “Setting Attribute and Resource Values”, on page 166</a>   |
| unset     | u     | Unsets value of attribute                  | See <a href="#">section 2.47.7.2, “Unsetting Attribute and Resource Values”, on page 167</a>   |

## 2.47.5 Arguments to Directive Commands

### 2.47.5.1 Object Arguments to Directive Commands

The qmgr command can operate on objects (servers, schedulers, queues, vnodes, resources, hooks, and built-in hooks). Each of these can be abbreviated inside a directive. The following table lists the objects and their abbreviations:

**Table 2-17: qmgr Objects**

| Object Name     | Abbr.     | Object            | Can Be Created/Deleted By:                   | Can Be Modified By:                          |
|-----------------|-----------|-------------------|--|--|
| <i>server</i>   | <i>s</i>  | server            | No one (created at installation)             | Administrator, Operator, Manager             |
| <i>sched</i>    | <i>sc</i> | default scheduler | No one (created at installation)             | Administrator, Operator, Manager             |
|                 |           | multisched        | Administrator, Manager                       | Administrator, Operator, Manager             |
| <i>queue</i>    | <i>q</i>  | queue             | Administrator, Operator, Manager             | Administrator, Operator, Manager             |
| <i>node</i>     | <i>n</i>  | vnode             | Administrator, Operator, Manager             | Administrator, Operator, Manager             |
| <i>resource</i> | <i>r</i>  | resource          | Administrator, Manager                       | Administrator, Manager                       |
| <i>hook</i>     | <i>h</i>  | hook              | Linux: root<br>Windows: installation account | Linux: root<br>Windows: installation account |
| <i>pbshook</i>  | <i>p</i>  | built-in hook     | No one (created at installation)             | Linux: root<br>Windows: installation account |

### 2.47.5.1.i Specifying Active Server

The `qmgr` command operates on objects (queues, vnodes, etc.) at the active server. There is always at least one active server; the default server is the active server unless other servers have been made active. The default server is the server managing the host where the `qmgr` command runs, meaning it is the server specified in that host's `pbs.conf` file. Server names have the following format:

`<hostname>[:<port number>]`

where *hostname* is the fully-qualified domain name of the host on which the server is running and *port number* is the port number to which to connect. If *port number* is not specified, the default port number, **15001**, is used.

- To specify the default server:

`@default`

- To specify a named server:

`@<server name>`

- To specify all active servers:

`@active`

### 2.47.5.1.ii Using Lists of Object Names

In a `qmgr` directive, *object name(s)* is a list of one or more names of specific objects. The administrator specifies the name of an object when creating the object. The name list is in the form:

`<object name>[@<server>][,<object name>[@<server>] ...]`

where *server* is replaced in the directive with "**default**", "**active**", or the name of the server. The name list must conform to the following:

- There must be no space between the object name and the `@` sign.
- Name lists must not contain white space between entries.
- All objects in a list must be of the same type.
- Node attributes cannot be used as vnode names.

### 2.47.5.1.iii Specifying Object Type and Name

You can specify objects in the following ways:

- To act on the active objects of the named type, at the active server:

`<object type>`

For example, to list all active vnodes, along with their attributes, at the active server:

**Qmgr: list node**

- To act on the active objects of the named type, at a specified server:

`<object type> @<server name>` (note space before `@` sign)

For example, to list all active vnodes at the default server, along with their attributes:

**Qmgr: list node @default**

For example, to print out all queues at the default server, along with their attributes:

**qmgr -c "print queue @default"**

- To act on a specific named object:

`<object type> <object name>`

For example, to list Node1 and its attributes:

**Qmgr: list node Node1**

To list queues workq, slowq, and fastq at the active server:

```
Qmgr: list queue workq,slowq,fastq
```

- To act on the named object at the specified server:

```
<object type> <object name>@<server name>
```

For example, to list Node1 at the default server, along with the attributes of Node1:

```
Qmgr: list node Node1@default
```

To list queues Queue1 at the default server, Queue2 at Server2, and Queue3 at the active server:

```
Qmgr: list queue Queue1@default,Queue2@Server2,Queue3@active
```

### 2.47.5.2 Operators in Directive Commands

In a qmgr directive, *operator* is the operation to be performed with the attribute and its value. Operators are listed here:

**Table 2-18: Operators in Directive Commands**

| Operator | Effect   |
|----------|--|
| =        | Sets the value of the attribute or resource. If the attribute or resource has an existing value, the current value is replaced with the new value.                         |
| +=       | Increases the current value of the attribute or resource by the amount in the new value. When used for a string array, adds the new value as another string after a comma. |
| -=       | Decreases the current value of the attribute or resource by the specified amount. When used for a string array, removes the first matching string.                         |

Example 2-4: Set routing destination for queue Queue1 to be Dest1:

```
Qmgr: set queue route_destinations = Dest1
```

Example 2-5: Add new routing destination for queue Queue1:

```
Qmgr: set queue route_destinations += Dest2
```

Example 2-6: Remove new routing destination for queue Queue1:

```
Qmgr: set queue route_destinations -= Dest2
```

When setting numerical resource values, you can use only the equal sign ("=").

### 2.47.5.3 Windows Requirements For Directive Arguments

Under Windows, use double quotes when specifying arguments to qmgr. For example:

```
Qmgr: import hook hook1 application/x-python default "\Documents and Settings\pbsuser1\hook1.py"
```

or

```
qmgr -c 'import hook hook1 application/x-python default "\Documents and Settings\pbsuser1\hook1.py"'
```

## 2.47.6 Operating on Objects (Server, Scheduler, Vnode, Queue, Hook)

### 2.47.6.1 Making Objects Active

Making objects active is a way to set up a list of objects, all of the same type, on which you can then use a single command. For example, if you are going to set the same attribute to the same value on several vnodes, you can make all of the target vnodes active before using a single command to set the attribute value, instead of having to give the command once for each vnode. You can make any type of object active except for resources or hooks.

When an object is active, it is acted upon when you specify its type but do not specify names. When you specify any object names in a directive, active objects are not operated on unless they are named in the directive.

You can specify a list of active objects for each type of object. You can have active objects of multiple types at the same time. The active objects of one type have no effect on whether objects of another type are active.

Objects are active only until the `qmgr` command is exited, so this feature can be used only at the `qmgr` prompt.

Each time you make any objects active at a given server, that list of objects replaces any active objects of the same kind at that server. For example, if you have four queues at a particular server, and you make Q1 and Q2 active, then later make Q3 and Q4 active, the result is that Q3 and Q4 are the only active queues.

You can make different objects be active at different servers simultaneously. For example, you can set vnodes N1 and N2 at the default server, and vnodes N3 and N4 at server `Server2` to be active at the same time.

To make all objects inactive, quit `qmgr`. When you quit `qmgr`, any object that was active is no longer active.

#### 2.47.6.1.i Using the `active` Command

- To make the named object(s) of the specified type active:

*active <object type> [<object name>[, <object name> ...]]*

Example: To make queue `Queue1` active:

```
Qmgr: active queue Queue1
```

Example: To make queues `Queue1` and `Queue2` at the active server be active, then enable them:

```
Qmgr: active queue Queue1,Queue2
```

```
Qmgr: set queue enabled=True
```

Example: To make queue `Queue1` at the default server and queue `Queue2` at `Server2` be active:

```
Qmgr: active queue Queue1@default,Queue2@Server2
```

Example: To make vnodes `N1`, `N2`, `N3`, and `N4` active, and then give them all the same value for their `max_running` attribute:

```
Qmgr: active node N1,N2,N3,N4
```

```
Qmgr: set node max_running = 2
```

- To make all object(s) of the specified type at the specified server active:

*active <object type> @<server name>* (note space before `@` sign)

Example: To make all queues at the default server active:

```
Qmgr: active queue @default
```

Example: To make all vnodes at server `Server2` active:

```
Qmgr: active node @Server2
```

- To report which objects of the specified type are active:

*active <object type>*

The `qmgr` command prints a list of names of active objects of the specified type to `stdout`.



## 2.47.6.2 Creating Objects (Server, Scheduler, Vnode, Queue, Hook)

- To create one new object of the specified type for each name, and give it the specified name:

```
create <object type> <object name>[,<object name> ...] [[<attribute> = <value>] [,<attribute> = <value>] ...]
```

Can be used only with multischeds, queues, vnodes, resources, and hooks. Cannot be used with built-in hooks.

For example, to create a multisched named multisched\_1 at the active server:

```
Qmgr: create sched multisched_1
```

For example, to create a queue named Q1 at the active server:

```
Qmgr: create queue Q1
```

For example, to create a vnode named N1 and a vnode named N2:

```
Qmgr: create node N1,N2
```

For example, to create queue Queue1 at the default server and queue Queue2 at Server2:

```
Qmgr: create queue Queue1@default,Queue2@Server2
```

For example, to create vnodes named N1, N2, N3, and N4 at the active server, and to set their Mom attribute to *Host1* and their max\_running attribute to 1:

```
Qmgr: create node N1,N2,N3,N4 Mom=Host1, max_running = 1
```

To create a host-level consumable string resource named "foo" that can be read and set by execution hooks:

```
Qmgr: qmgr -c "create resource foo type=string,flag=mnh"
```

All objects of the same type at a server must have unique names. For example, each queue at server Server1 must have a unique name. Objects at one server can have the same name as objects at another server.

You can create multiple objects of the same type with a single command. You cannot create multiple types of objects in a single command.

To create multiple resources of the same type and flag, separate each resource name with a comma:

```
qmgr -c "create resource <resource>[,<resource> ...] type=<type>,flag=<flag(s)>"
```

### 2.47.6.2.i Examples of Creating Objects

Example 2-7: Create queue:

```
create queue fast priority=10,queue_type=e,enabled = true,max_running=0
```

Example 2-8: Create queue, set resources:

```
create queue little  
set queue little resources_max.mem=8mw,resources_max.cput=10
```

## 2.47.6.3 Deleting Objects

- To delete the named object(s):

```
delete <object type> <object name>[,<object name> ...]
```

When you delete more than one object, do not put a space after a comma.

Can be used only with queues, vnodes, resources, and hooks. Cannot be used with built-in hooks.

For example, to delete queue Q1 at the active server:

```
Qmgr: delete queue Q1
```

For example, to delete vnodes N1 and N2 at the active server:

```
Qmgr: delete node N1,N2
```

For example, to delete queue Queue1 at the default server and queue Queue2 at Server2:

```
Qmgr: delete queue Queue1@default,Queue2@Server2
```

For example, to delete resource "foo" at the active server:

```
Qmgr: delete resource foo
```

- To delete the active objects of the specified type:

```
delete <object type>
```

For example, to delete the active queues:

```
Qmgr: delete queue
```

- To delete the active objects of the specified type at the specified server:

```
delete <object type> @<server name>
```

For example, to delete the active queues at server Server2:

```
Qmgr: delete queue @Server2
```

You can delete multiple objects of the same type with a single command. You cannot delete multiple types of objects in a single command. To delete multiple resources, separate the resource names with commas.

For example:

```
Qmgr: delete resource r1,r2
```

You cannot delete a resource that is requested by a job or reservation, or that is set on a server, queue, or vnode.

## 2.47.7 Operating on Attributes and Resources

You can specify attributes and resources for named objects or for all objects of a type.

### 2.47.7.1 Setting Attribute and Resource Values

- To set the value of the specified attribute(s) for the named object(s):

```
set <object type> <object name>[,<object name> ...] <attribute> = <value> [,<attribute> = <value> ...]
```

Each specified attribute is set for each named object, so if you specify three attributes and two objects, both objects get all three attributes set.

- To set the attribute value for all active objects when there are active objects of the type specified:

```
set <object type> <attribute> = <value>
```

- To set the attribute value for all active objects at the specified server when there are active objects of the type specified:

```
set <object type> @<server name> <attribute> = <value>
```

For example, to set the amount of memory on a vnode:

```
Qmgr: set node Vnode1 resources_available.mem = 2mb
```

If the attribute is one which describes a set of resources such as `resources_available`, `resources_default`, `resources_max`, `resources_used`, etc., the attribute is specified in the form:

```
<attribute name>.<resource name>
```

You can have spaces between *attribute=value* pairs.

### 2.47.7.1.i Examples of Setting Attribute Values

Example 2-9: Increase limit on queue:

```
set queue fast max_running +=2
```

Example 2-10: Set software resource on mynode:

```
set node mynode resources_available.software = "myapp=/tmp/foo"
```

Example 2-11: Set limit on queue:

```
set queue Queue1 max_running = 10
```

Example 2-12: Set vnode offline:

```
set node Node1 state = "offline"
```

### 2.47.7.2 Unsetting Attribute and Resource Values

You can use the `qmgr` command to unset attributes of any object, except for the `type` attribute of a built-in hook.

- To unset the value of the specified attributes of the named object(s):  
*unset <object type> <object name>[, <object name> ...] <attribute>[, <attribute>...]*
- To unset the value of specified attributes of active objects:  
*unset <object type> <attribute>[, <attribute>...]*
- To unset the value of specified attributes of the named object:  
*unset <object type> <object name> <attribute>[, <attribute>...]*
- To unset the value of specified attributes of the named object:  
*unset <object type> @<server name> <attribute>[, <attribute>...]*

#### 2.47.7.2.i Example of Unsetting Attribute Value

Example 2-13: Unset limit on queue

```
unset queue fast max_running
```

### 2.47.7.3 Caveats and Restrictions for Setting Attribute and Resource Values

- If the value includes whitespace, commas or other special characters, such as the `#` character, the value string must be enclosed in single or double quotes. For example:  
**Qmgr: set node Vnode1 comment="Node will be taken offline Friday at 1:00 for memory upgrade."**
- You can set or unset attribute values for only one type of object in each command.
- You can use the `qmgr` command to set attributes of any object, except for the `type` attribute of a built-in hook.
- You can have spaces between attribute names.
- Attribute and resource values must conform to the format for the attribute or resource type. Each attribute's type is listed in [Chapter 6, "Attributes", on page 281](#). Each format is described in [Chapter 7, "Formats", on page 357](#).
- Most of a vnode's attributes may be set using `qmgr`. However, some **must** be set on the individual execution host in Version 2 vnode configuration files, NOT by using `qmgr`. See ["Configuring Vnodes" on page 47 in the PBS Professional Administrator's Guide](#).

### 2.47.7.4 Setting Custom Resource Type

You can use the `qmgr` command to set or unset the type for custom resources.

Resource types can be the following; see [section 7.2, “Resource Formats”, on page 363](#):

*string*  
*boolean*  
*string\_array*  
*long*  
*size*  
*float*

- To set a custom resource type:

```
set resource <resource name> type = <type>
```

Sets the type of the named resource to the specified *type*. For example:

```
Qmgr: qmgr -c "set resource foo type=string_array"
```

### 2.47.7.5 Setting Custom Resource Level and Consumability

When you define a custom resource, you specify whether it is server-level or host-level, and whether it is consumable or not by setting resource accumulation flags via `qmgr`. A consumable resource is tracked, or accumulated, in the server, queue or vnode resources\_assigned attribute. The resource accumulation flags determine where the value of resources\_assigned.<resource name> is incremented.

#### 2.47.7.5.i Allowable Values for Resource Accumulation Flags

The value of <resource flags>, which is the resource accumulation flag for a resource can be one of the following:

**Table 2-19: Resource Accumulation Flags**

| Flag       | Meaning   |
|------------|---|
| (no flags) | Indicates a queue-level or server-level resource that is not consumable.  |
| <i>fh</i>  | <p>The amount is consumable at the host level for only the first vnode allocated to the job (vnode with first task.) Must be consumable or time-based. Cannot be used with Boolean or string resources. .</p> <p>This flag specifies that the resource is accumulated at the first vnode, meaning that the value of resources_assigned.&lt;resource&gt; is incremented only at the first vnode when a job is allocated this resource or when a reservation requesting this resource on this vnode starts.</p> |

**Table 2-19: Resource Accumulation Flags**

| Flag      | Meaning   |
|-----------|---|
| <i>h</i>  | <p>Indicates a host-level resource. Used alone, means that the resource is not consumable. Required for any resource that will be used inside a select statement. This flag selects hardware. This flag indicates that the resource must be requested inside of a select statement.</p> <p>Example: for a Boolean resource named "green":</p> <pre><b>Qmgr: create resource green type=boolean, flag=h</b></pre>  |
| <i>nh</i> | <p>The amount is consumable at the host level, for all vnodes assigned to the job. Must be consumable or time-based. Cannot be used with Boolean or string resources.</p> <p>This flag specifies that the resource is accumulated at the vnode level, meaning that the value of <code>resources_assigned.&lt;resource&gt;</code> is incremented at relevant vnodes when a job is allocated this resource or when a reservation requesting this resource on this vnode starts.</p> <p>This flag is not used with dynamic consumable resources. The scheduler will not oversubscribe dynamic consumable resources.</p>  |
| <i>q</i>  | <p>The amount is consumable at the queue and server level. When a job is assigned one unit of a resource with this flag, the <code>resources_assigned.&lt;resource&gt;</code> attribute at the server and any queue is incremented by one. Must be consumable or time-based.</p> <p>This flag specifies that the resource is accumulated at the queue and server level, meaning that the value of <code>resources_assigned.&lt;resource&gt;</code> is incremented at each queue and at the server when a job is allocated this resource. When a reservation starts, allocated resources are added to the server's <code>resources_assigned</code> attribute.</p> <p>This flag is not used with dynamic consumable resources. The scheduler will not oversubscribe dynamic consumable resources.</p> |

### 2.47.7.5.ii When to Use Accumulation Flags

The following table shows when to use accumulation flags.

**Table 2-20: When to Use Accumulation Flags**

| Resource Category      | Server  | Queue                         | Host  |
|------------------------|---|-------------------------------|---|
| Static, consumable     | flag = q  | flag = q                      | flag = nh or fh                                     |
| Static, not consumable | flag = (none of h, n, q or f)   | flag = (none of h, n, q or f) | flag = h  |
| Dynamic                | server_dyn_res line in sched_config,<br>flag = (none of h, n, q or f) | (cannot be used)              | Tracked using an exechost_periodic hook<br>flag = h |

### 2.47.7.5.iii Example of Resource Accumulation Flags

When defining a static consumable host-level resource, such as a node-locked application license, you would use the "n" and "h" flags.

When defining a dynamic resource such as a floating license, you would use no flags.

### 2.47.7.5.iv Resource Accumulation Flag Restrictions and Caveats

Numeric dynamic resources cannot have the `q` or `n` flags set. This would cause these resources to be under-used. These resources are tracked automatically by the scheduler.

### 2.47.7.6 Setting Custom Resource Visibility

When you define a custom resource, you can specify whether unprivileged users have permission to view or request the resource, and whether users can `qalter` a request for that resource. This is done by setting a resource permission flag via `qmgr`.

#### 2.47.7.6.i Allowable Values for Resource Permission Flags

The permission flag for a resource can be one of the following:

**Table 2-21: Resource Permission Flags**

| Flag      | Meaning  |
|-----------|--|
| (no flag) | Users can view and request the resource, and <code>qalter</code> a resource request for this resource.                         |
| <i>i</i>  | "Invisible". Users cannot view or request the resource. Users cannot <code>qalter</code> a resource request for this resource. |
| <i>r</i>  | "Read only". Users can view the resource, but cannot request it or <code>qalter</code> a resource request for this resource.   |

#### 2.47.7.6.ii Effect of Resource Permission Flags

- PBS Operators and Managers can view and request a resource, and `qalter` a resource request for that resource, regardless of the `i` and `r` flags.
- Users, operators and managers cannot submit a job which requests a restricted resource. Any job requesting a restricted resource will be rejected. If a manager needs to run a job which has a restricted resource with a different value from the default value, the manager must submit the job without requesting the resource, then `qalter` the resource value.
- While users cannot request these resources, their jobs can inherit default resources from `resources_default.<resource name>` and `default_chunk.<resource name>`.

If a user tries to request a resource or modify a resource request which has a resource permission flag, they will get an error message from the command and the request will be rejected. For example, if they try to `qalter` a job's resource request, they will see an error message similar to the following:

```
"qalter: Cannot set attribute, read only or insufficient permission Resource_List.hps 173.mars"
```

#### 2.47.7.6.iii Resource Permission Flag Restrictions and Caveats

- You can specify only one of the `i` or `r` flags per resource. If both are specified, the resource is treated as if only the `i` flag were specified, and an error message is logged at the default log level and printed to standard error.
- Resources assigned from the `default_qsub_arguments` server attribute are treated as if the user requested them. A job will be rejected if it requests a resource that has a resource permission flag whether that resource was requested by the user or came from `default_qsub_arguments`.
- The behavior of several command-line interfaces is dependent on resource permission flags. These interfaces are those which view or request resources or modify resource requests:

**pbsnodes**

Users cannot view restricted host-level custom resources.

**pbs\_rstat**

Users cannot view restricted reservation resources.

**pbs\_rsub**

Users cannot request restricted custom resources for reservations.

**qalter**

Users cannot alter a restricted resource.

**qmgr**

Users cannot print or list a restricted resource.

**qselect**

Users cannot specify restricted resources via -l Resource\_List.

**qsub**

Users cannot request a restricted resource.

**qstat**

Users cannot view a restricted resource.

### 2.47.7.7 Specifying Whether Custom Resource is Cached at MoM

You can make it faster for execution hooks to read custom job resources. Execution hooks cannot read custom job resources via the event, only via the server. However, you can cache a copy of a custom job resource at the MoMs for faster local reading by execution hooks, by setting the *m* flag for the resource. The job resources that can be cached are found in the following job attributes:

`exec_vnode`

`Resource_List`

`resources_used`

To create a resource with the *m* flag set, include the flag. For example, to create two host-level consumable resources `r1` and `r2` of type `long` that will be cached at MoMs:

```
qmgr -c "create resource r1,r2 type=long,flag=mnh"
```

To unset this flag for `r1`:

```
qmgr -c "set resource r1 flag=nh"
```

You can combine this flag with any other resource flag. Job resources created in an `exechost_startup` hook have the *m* flag set automatically.

#### 2.47.7.7.i Caveats for Caching Custom Job Resources

Large numbers of job resources that are cached at MoMs can slow things down. If you don't need execution hooks to be able to read a custom job resource often, don't cache the resource at the MoMs.

#### 2.47.7.7.ii Examples of Defining Custom Resources and Setting Flags via qmgr

To set the type for a resource:

```
set resource <resource name> type = <type>
```

For example:

```
qmgr -c "set resource foo type=string_array"
```

To set the flags for a resource:

```
set resource <resource name> flag=<flag(s)>
```

For example:

```
qmgr -c "set resource foo flag=nh"
```

To set the type and flags for a resource:

```
set resource <resource name> type=<type>, flag=<flag(s)>
```

For example:

```
qmgr -c "set resource foo type=long, flag=nhi"
```

You can set multiple resources by separating the names with commas. For example:

```
qmgr -c "set resource r1, r2 type=long"
```

You cannot set the *nh*, *fh*, or *q* flag for a resource of type *string*, *string\_array*, or *Boolean*.

You cannot set both the *n* and the *f* flags on one resource.

You cannot have the *n* or *f* flags without the *h* flag.

You cannot set both the *i* and *r* flags on one resource.

You cannot unset the type for a resource.

You cannot set the type for a resource that is requested by a current or history job or reservation, or set on a server, queue, or vnode.

You cannot set the flag(s) to *h*, *nh*, *fh*, or *q* for a resource that is currently requested by a current or history job or reservation.

You cannot unset the flag(s) for a resource that is currently requested by a current or history job or a reservation, or set on any server, queue, or vnode.

You cannot alter a built-in resource.

You can unset custom resource flags, but not their type.

## 2.47.8 Viewing Object, Attribute, and Resource Information

### 2.47.8.1 Listing Objects and Their Attributes

You can use the `qmgr` command to list attributes of any object, including attributes at their default values.

- To list the attributes, with associated values, of the named object(s):

```
list <object type> <object name>[, <object name> ...]
```

- To list values of the specified attributes of the named object:

```
list <object type> <object name> <attribute name>[, <attribute name>]...
```

- To list attributes, with associated values, of active objects of the specified type at the active server:

```
list <object type>
```

- To list all objects of the specified type at the specified server, with their attributes and the values associated with the attributes:

```
list <object type> @<server name>
```

- To list attributes of the active server:



*list server*

If no server other than the default server has been made active, lists attributes of the default server (it is the active server).

- To list attributes of the specified server:

*list server <server name>*

- To list attributes of all schedulers:

*list sched*

- To list attributes of the specified scheduler:

*list sched <scheduler name>*

- To list all hooks, along with their attributes:

*list hook*

- To list attributes of the specified hook:

*list hook <hook name>*

### 2.47.8.1.i Examples of Listing Objects and Their Attributes

Example 2-14: List serverA's schedulers' attributes:

```
list sched @serverA
```

Example 2-15: List attributes for default server's scheduler(s):

```
l sched @default
```

Example 2-16: List PBS version for default server's scheduler(s):

```
l sched @default pbs_version
```

Example 2-17: List queues at a specified server:

```
list queue @server1
```

## 2.47.8.2 Listing Resource Definitions

You can use the `qmgr list` and `print` commands to list resource definitions showing resource name, type, and flag(s).

- To list the name, type, and flag(s) of the named resource(s):

*list resource <resource name>[,<resource name> ...]*

or

*print resource <resource name>[,<resource name> ...]*

- To list name, type, and flag(s) of custom resources only:

*list resource*

or

*print resource*

or

*print server* (note that this also prints information for the active server)

- To list all custom resources at the specified server, with their names, types, and flags:

*list resource @<server name>*

or

*print resource @<server name>*

When used by a non-privileged user, `qmgr` prints only resource definitions for resources that are visible to non-privileged users (those that do not have the *i* flag set).

### 2.47.8.3 Printing Creation and Configuration Commands

For printing the creation commands for any object except for a built-in hook.

- To print out the commands to create the named object(s) and set their attributes to their current values:  
`print <object type> <object name>[, <object name> ...]`  
 where *object name* follows the name rules in [section 2.47.5.1.ii, “Using Lists of Object Names”, on page 162](#).
- To print out the commands to create the named object and set its attributes to their current values:  
`print <object type> <object name> [<attribute name>[, <attribute name>]...]`  
 where *object name* follows the name rules in [section 2.47.5.1.ii, “Using Lists of Object Names”, on page 162](#).
- To print out the commands to create and configure the active objects of the named type:  
`print <object type>`
- To print out the commands to create and configure all of the objects of the specified type at the specified server:  
`print <object type> @<server name>`
- To print out the commands to create each queue, set the attributes of each queue to their current values, and set the attributes of the server to their current values:  
`print server`  
 This is used for the server and queues, but not hooks.  
 Prints information for the active server. If there is no active server, prints information for the default server.
- To print out the creation commands for all schedulers:  
`print sched`
- To print out the creation commands for the specified scheduler:  
`print sched <scheduler name>`

### 2.47.8.4 Caveats for Viewing Information

Some attributes whose values are unset do not appear in the output of the `qmgr` command.

Definitions for built-in resources do not appear in the output of the `qmgr` command.

When a non-privileged user prints resource definitions, `qmgr` prints only resource definitions for resources that are visible to non-privileged users (those that do not have the *i* flag set).

### 2.47.9 Saving and Re-creating Server and Queue Information

To save and recreate server and queue configuration, print the configuration information to a file, then read it back in later. For example, to save your configuration:

```
# qmgr -c "print server" > savedsettings
```

When re-creating queue and server configuration, read the commands back into `qmgr`. For example:

```
qmgr < savedsettings
```

## 2.47.10 Operating on Hooks

### 2.47.10.1 Creating Hooks

- To create a hook:

*Qmgr: create hook <hook name>*

For example:

**Qmgr: create hook my\_hook**

### 2.47.10.2 Deleting Hooks

- To delete a hook:

*Qmgr: delete hook <hook name>*

For example:

**Qmgr: delete hook my\_hook**

### 2.47.10.3 Setting and Unsetting Hook Attributes

- To set a hook attribute:

*Qmgr: set hook <hook name> <attribute> = <value>*

- To unset a hook attribute:

*Qmgr: unset hook <hook name> <attribute>*

Example 2-18: Unset hook1's **alarm** attribute, causing hook1's **alarm** to revert to its default value of 30 seconds:

**Qmgr: unset hook hook1 alarm**

### 2.47.10.4 Importing Hooks

For importing the contents of a site-defined hook. Cannot be used with built-in hooks.

To import a hook, you import the contents of a hook script into the hook. You must specify a filename that is locally accessible to **qmgr** and the PBS server.

Format for importing a site-defined hook:

*import hook <hook name> application/x-python <content encoding> {<input file> | -}*

This uses the contents of *input file* or **stdin** (-) as the contents of hook *hook name*.

- The *input file* or **stdin** (-) data must have a format of *content type* and must be encoded with *content encoding*.
- The allowed values for *content encoding* are "**default**" (7bit) and "**base64**".
- If the source of input is **stdin** (-) and *content encoding* is "**default**", **qmgr** expects the input data to be terminated by **EOF**.
- If the source of input is **stdin** (-) and *content encoding* is "**base64**", **qmgr** expects input data to be terminated by a blank line.
- input file* must be locally accessible to both **qmgr** and the requested batch server.
- A relative path *input file* is relative to the directory where **qmgr** was executed.
- If a hook already has a content script, that is overwritten by this import call.
- If the name in *input file* contains spaces as are used in Windows filenames, *input file* must be quoted.

There is no restriction on the size of the hook script.

### 2.47.10.4.i Examples of Importing Hooks

Example 2-19: Given a Python script in ASCII text file "hello.py", use its contents as the script contents of hook1:

```
#cat hello.py
import pbs
pbs.event().job.comment="Hello, world"
# qmgr -c 'import hook hook1 application/x-python default hello.py'
```

Example 2-20: Given a base64-encoded file "hello.py.b64", qmgr unencodes the file's contents, and then makes this the script contents of hook1:

```
# cat hello.py.b64
cHJpbnQgImhlbGxvLCB3b3JsZCIK
# qmgr -c 'import hook hook1 application/x-python base64 hello.py.b64'
```

Example 2-21: To create a provisioning hook called Provision\_Hook, and import the ASCII hook script called "master\_provision.py" located in /root/data/:

```
Qmgr: create hook Provision_Hook
Qmgr: import hook Provision_Hook application/x-python default
      /root/data/master_provision.py
```

## 2.47.10.5 Importing and Exporting Hook Configuration Files

### 2.47.10.5.i Importing Configuration Files

For importing the contents of a site-defined or built-in hook configuration file. To import a hook configuration file, you import the contents of a file to a hook. You must specify a filename that is locally accessible to qmgr and the PBS server.

Format for importing a site-defined hook configuration file:

```
import hook <hook name> application/x-config <content encoding> {<config file>|-}
```

Format for importing a built-in hook configuration file:

```
import pbshook <hook name> application/x-config <content encoding> {<config file>|-}
```

This uses the contents of *config file* or *stdin* (-) as the contents of the configuration file for hook *hook name*.

- The *config file* or *stdin* (-) data must have a format of *content-type* and must be encoded with *content encoding*.
- The allowed values for *content encoding* are "default" (7bit) and "base64".
- If the source of input is *stdin* (-) and *content encoding* is "default", qmgr expects the input data to be terminated by EOF.
- If the source of input is *stdin* (-) and *content encoding* is "base64", qmgr expects input data to be terminated by a blank line.
- *config file* must be locally accessible to both qmgr and the requested batch server.
- A relative path *config file* is relative to the directory where qmgr was executed.
- If a hook already has a configuration file, that file is overwritten by this import call.
- If the name in *config file* contains spaces as are used in Windows filenames, *input file* must be quoted.

There is no restriction on the size of the hook configuration file.

### 2.47.10.5.ii Exporting Configuration Files

Format for exporting a site-defined hook configuration file:

```
qmgr -c "export hook <hook name> application/x-config default" > {<config file>|-}
```

Format for exporting a built-in hook configuration file:

```
qmgr -c "export pbshook <hook name> application/x-config default" > {<config file>|-}
```

### 2.47.10.5.iii Hook Configuration File Format

PBS supports several file formats for configuration files. The format of the file is specified in its suffix. Formats can be any of the following:

- .ini
- .json
- .py (Python)
- .txt (generic, no special format)
- .xml
- No suffix: treat the input file as if it is a .txt file
- The dash (-) symbol: configuration file content is taken from `STDIN`. The content is treated as if it is a .txt file.

Example 2-22: To import a configuration file in .json format:

```
# qmgr -c "import hook my_hook application/x-config default my_input_file.json"
```

## 2.47.10.6 Exporting Hooks

For exporting the contents of a site-defined hook. Cannot be used with built-in hooks.

Format for exporting a hook:

```
qmgr -c "export hook <hook name> <content type> <content encoding>" > [<output file>]
```

This dumps the script contents of hook *hook name* into *output file*, or `stdout` if *output file* is not specified.

- The resulting *output file* or `stdout` data is of *content type* and *content encoding*.
- The only *content type* currently supported is "application/x-python".
- The allowed values for *content encoding* are "default" (7bit) and "base64".
- *output file* must be a path that can be created by `qmgr`.
- Any relative path *output file* is relative to the directory where `qmgr` was executed.
- If *output file* already exists it is overwritten. If PBS is unable to overwrite the file due to ownership or permission problems, an error message is displayed in `stderr`.
- If the *output file* name contains spaces like the ones used in Windows file names, *output file* must be enclosed in quotes.

### 2.47.10.6.i Examples of Exporting Hooks

Example 2-23: Dump hook1's script contents directly into a file "hello.py.out":

```
# qmgr -c "export hook hook1 application/x-python default" > hello.py
# cat hello.py
import pbs
pbs.event().job.comment="Hello, world"
```

Example 2-24: To< dump the script contents of a hook 'hook1' into a file in "\My Hooks\hook1.py":

```
qmgr -c "export hook hook1 application/x-python default" > "\My Hooks\hook1.py"
```

## 2.47.10.7 Printing Hook Information

- To print out the commands to create and configure all hooks, including their configuration files:

*print hook*

- To print out the commands to create and configure the specified hook, including its configuration file:

*print hook <hook name>*

### 2.47.10.8 Saving and Re-creating Hook Information

You can save creation and configuration information for all hooks. For example:

```
# qmgr -c "print hook" > hook.qmgr
```

You can re-create all hooks and their configuration files. For example:

```
# qmgr < hook.qmgr
```

### 2.47.10.9 Restrictions on Built-in Hooks

You cannot do the following with built-in hooks:

- Import a built-in hook
- Export a built-in hook
- Print creation commands for a built-in hook
- Create a built-in hook
- Delete a built-in hook
- Set the `type` attribute for a built-in hook

### 2.47.11 Printing Usage Information

You use the `help` command or a question mark ("`?`") to invoke the `qmgr` built-in help function. You can request usage information for any of the `qmgr` commands, and for topics including attributes, operators, names, and values.

- To print out usage information for the specified command or topic:

*Qmgr: help [<command or topic>]*

or

*Qmgr: ? [<command or topic>]*

For example, to print usage information for the `set` command:

```
qmgr
```

```
Qmgr: help set
```

```
Syntax: set object [name][,name...] attribute[.resource] OP value
```

### 2.47.12 Standard Input

When you start a `qmgr` session, the `qmgr` command reads standard input for directives until it reaches end-of-file, or it reads the `exit` or `quit` command.

### 2.47.13 Standard Output

When you start a `qmgr` session, and standard output is connected to a terminal, `qmgr` writes a command prompt to standard output.

If you specify the `-e` option, `qmgr` echoes the directives it reads from standard input to standard output.

---

### 2.47.14 Standard Error

If you do not specify the `-z` option, the `qmgr` command writes a diagnostic message to standard error for each error occurrence.

### 2.47.15 Exit Status

- 0  
Success
- 1  
Error in parsing
- 2  
Error in execution
- 3  
Error connecting to server
- 4  
Error making object active
- 5  
Memory allocation error

### 2.47.16 See Also

The PBS Professional Administrator's Guide, [Chapter 6, "Attributes", on page 281](#), [Chapter 5, "List of Built-in Resources", on page 265](#)

## 2.48 qmove

Moves a PBS job from one queue to another

### 2.48.1 Synopsis

```
qmove <destination> <job ID> [<job ID> ...]
```

```
qmove --version
```

### 2.48.2 Description

Moves a job from one queue to another.

The behavior of the `qmove` command may be affected by any site hooks. Site hooks can modify the job's attributes, change its routing, etc.

#### 2.48.2.1 Restrictions

The `qmove` command can be used on job arrays, but not on subjobs or ranges of subjobs.

Job arrays can only be moved from one server to another if they are in the '*Q*', '*H*', or '*W*' states, and only if there are no running subjobs. The state of the job array is preserved, and the job array will run to completion on the new server.

A job in the *Running*, *Transiting*, or *Exiting* state cannot be moved.

A job in the process of provisioning cannot be moved.

#### 2.48.2.2 Effect of Privilege on Behavior

An unprivileged user can use the `qmove` command to move a job only when the move would not violate queue restrictions. A privileged user (root, Manager, Operator) can use the `qmove` command to move a job under some circumstances where an unprivileged user cannot. The following restrictions apply only to unprivileged users:

- The queue must be enabled
- Moving the job into the queue must not exceed the queue's limits for jobs or resources
- If the job is an array job, the size of the job array must not exceed the queue's `max_array_size`
- The queue cannot have its `from_route_only` attribute set to *True* (accepting jobs only from routing queues)

### 2.48.3 Options

`--version`

The `qmove` command returns its PBS version information and exits. This option can only be used alone.

### 2.48.4 Operands

`destination`

Where job(s) are to end up. First operand. Syntax:

`<queue name>`

Moves the job(s) into the specified queue at the job's current server.

`@<server name>`



---

Moves the job(s) into the default queue at specified server.

*<queue name>@<server name>*

Moves the job(s) into the specified queue at the specified server.

See [Chapter 7, "Formats", on page 357](#) for destination identifier formats.

#### job ID

Job(s) and/or job array(s) to be moved to the new destination . The `qmove` command accepts one or more *job ID* operands of the form:

*<sequence number>[.<server name>][@<server name>]*

*<sequence number>[[.<server name>][@<server name>]*

Note that some shells require that you enclose a job array identifier in double quotes.

## 2.48.5 Standard Error

The `qmove` command writes a diagnostic messages to standard error for each error occurrence.

## 2.48.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qmove` command.

### Greater than zero

If the `qmove` command fails to process any operand.

## 2.48.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide

## 2.49 qmsg

Writes message string into one or more job output files

### 2.49.1 Synopsis

```
qmsg [-E] [-O] <message string> <job ID> [<job ID> ...]
```

```
qmsg --version
```

### 2.49.2 Description

Writes a message string into one or more output files of the job. Typically this is done to leave an informative message in the output of the job. Also called "sending a message to a job".

The `qmsg` command writes messages into the files of jobs by sending a Message Job batch request to the batch server that owns the job. The `qmsg` command does not directly write the message into the files of the job.

The `qmsg` command can be used on jobs and subjobs, but not on job arrays or ranges of subjobs.

### 2.49.3 Options

`-E`

The message is written to the standard error of each job.

`-O`

The message is written to the standard output of each job.

`--version`

The `qmsg` command returns its PBS version information and exits. This option can only be used alone.

(no options)

The message is written to the standard error of each job.

### 2.49.4 Operands

message string

The message to be written. String. First operand. If the string contains blanks, the string must be quoted. If the final character of the string is not a newline, a newline character is added when written to the job's file.

job ID

The job(s) to receive the message string. This operand follows the *message string* operand. Can be a job or subjob. Cannot be a job array or range of subjobs. The `qmsg` command accepts one or more *job ID* operands.

Format for job:

```
<sequence number>[.<server name>][@<server name>]
```

Format for subjob. Note that a subjob has square brackets around its index number:

```
<sequence number>[<index>][.<server name>][@<server name>]
```

### 2.49.5 Standard Error

The `qmsg` command writes a diagnostic message to standard error for each error occurrence.

---

## 2.49.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qmsg` command.

### Greater than zero

If the `qmsg` command fails to process any operand.

## 2.49.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide

## 2.50 qorder

Swaps queue positions of two PBS jobs

### 2.50.1 Synopsis

*qorder <job ID> <job ID>*

*qorder --version*

### 2.50.2 Description

Exchanges positions in queue(s) of two jobs, whether in the same or different queue(s).

No attribute of either job, e.g. `priority`, is changed. The impact of interchanging the order within or between queues is dependent on local job scheduling policy; contact your systems administrator.

#### 2.50.2.1 Restrictions

- A job in the running state cannot be reordered.
- The `qorder` command can be used on job arrays, but not on subjobs or ranges of subjobs.
- The two jobs must be located at the same server.

#### 2.50.2.2 Effect of Privilege on Behavior

For an unprivileged user to reorder jobs, both jobs must be owned by the user. A privileged user (Manager, Operator) can reorder any jobs.

### 2.50.3 Options

`--version`

The `qorder` command returns its PBS version information and exits. This option can only be used alone.

### 2.50.4 Operands

Both operands are job IDs which specify the jobs to be exchanged. The `qorder` command accepts two *job ID* operands of the form:

*<sequence number>[.<server name>][@<server name>]*

*<sequence number>[[.<server name>][@<server name>]*

If you specify the server for both jobs, they must be at the same server.

Note that some shells require that you enclose a job array identifier in double quotes.

### 2.50.5 Standard Error

The `qorder` command writes diagnostic messages to standard error for each error occurrence.

---

## 2.50.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qorder` command

### Greater than zero

If the `qorder` command fails to process any operand

## 2.50.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide

## 2.51 qrerun

Requeues a PBS job

### 2.51.1 Synopsis

```
qrerun [-W force] <job ID> [<job ID> ...]
```

```
qrerun --version
```

### 2.51.2 Description

If possible, kills the specified job(s), then requeues each job in the execution queue from which it was run.

The `qrerun` command can be used on jobs, job arrays, subjobs, and ranges of subjobs. If you give a job array identifier as an argument, the job array is returned to its initial state at submission time, or to its altered state if it has been `qalter`d. All of that job array's subjobs are requeued, which includes those that are currently running, and those that are completed and deleted. If a you give a subjob or range as an argument, those subjobs are requeued.

#### 2.51.2.1 Restrictions

If a job is marked as not rerunnable, `qrerun` neither kills nor requeues the job. See the `-r` option for the `qsub` and `qalter` commands, and the `Rerunable` job attribute.

The `qrerun` command cannot requeue a job or subjob which is not running, is held, or is suspended.

#### 2.51.2.2 Required Privilege

PBS Manager or Operator privilege is required to use this command.

### 2.51.3 Options

`-W force`

The job is to be requeued even if the vnode on which the job is executing is unreachable, or if the job's substate is *provisioning*.

`--version`

The `qrerun` command returns its PBS version information and exits. This option can only be used alone.

### 2.51.4 Operands

The `qrerun` command accepts one or more *job ID* operands of the form:

```
<sequence number>[.<server name>][@<server name>]
```

```
<sequence number>[[.<server name>][@<server name>]
```

```
<sequence number>[<index>][.<server name>][@<server name>]
```

```
<sequence number>[<index start>-<index end>][.<server name>][@<server name>]
```

Note that some shells require that you enclose a job array identifier in double quotes.

---

## 2.51.5 Standard Error

The `qrerun` command writes a diagnostic message to standard error for each error occurrence.

## 2.51.6 Exit Status

Zero

Upon successful processing of all operands

Greater than zero

Upon failure to process any operand

## 2.51.7 See Also

PBS Professional Administrator's Guide, PBS Professional User's Guide

## 2.52 qrls

Releases holds on PBS jobs

### 2.52.1 Synopsis

```
qrls [-h <hold list>] <job ID> [<job ID> ...]
```

```
qrls --version
```

### 2.52.2 Description

The `qrls` command directly releases or removes holds on batch jobs or job arrays, and indirectly on subjobs with a System hold. You cannot use the command with a specified range of subjobs. If you use `qrls` on a job array which has a System hold because it has one or more subjobs with a System hold, the System hold is removed from the subjobs, then from the job array.

A job may have one or more types of holds which make the job ineligible for execution.

When you `qrls` a job whose `Execution_Time` attribute is not set to a time in the future, the job changes to the *queued* state. If `Execution_Time` is in the future, the job changes to the *waiting* state.

Holds can be set by the owner, an Operator, or Manager, when a job has a dependency, or when a job has its `Execution_Time` attribute set to a time in the future. See "[qhold](#)" on page 155.

#### 2.52.2.1 Effect of Privilege on Behavior

The following table shows the holds and the privilege required to release each:

**Table 2-22: Hold Types**

| Hold Type | Meaning             | Privilege Required to Release  |
|-----------|---------------------|--|
| <i>u</i>  | <i>User</i>         | <i>Job owner, Operator, Manager, <a href="#">PBS Administrator</a>, root</i> |
| <i>o</i>  | <i>Other</i>        | <i>Operator, Manager, administrator, root</i>                                |
| <i>s</i>  | <i>System</i>       | <i>Manager, administrator, root, PBS (dependency)</i>                        |
| <i>n</i>  | <i>No hold</i>      | <i>Job owner, Operator, Manager, administrator, root</i>                     |
| <i>p</i>  | <i>Bad password</i> | <i>Administrator, root</i>   |

If you try to release a hold for which the you do not have privilege, the entire request is rejected, and no holds are released.

### 2.52.3 Options

(no options)

Defaults to `-h u`, removing *user* hold.

`-h <hold list>`

Types of hold to be released for the jobs. The *hold list* option argument is a string consisting of one or more of the letters *u*, *o*, or *s* in any combination, or one of the letters *n* or *p*.



---

**--version**

The `qrls` command returns its PBS version information and exits. This option can only be used alone.

## 2.52.4 Operands

The `qrls` command can be used directly on jobs and job arrays, but indirectly on subjobs, and cannot be used on ranges of subjobs. The `qrls` command accepts one or more *job ID* operands of the form:

`<sequence number>[.<server name>][@<server name>]`

`<sequence number>[[.<server name>][@<server name>]`

Note that some shells require that you enclose a job array identifier in double quotes.

## 2.52.5 Standard Error

The `qrls` command writes a diagnostic message to standard error for each error occurrence.

## 2.52.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qrls` command

### Greater than zero

If the `qrls` command fails to process any operand

## 2.52.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["qhold" on page 155](#)

## 2.53 qrun

Runs a PBS job immediately

### 2.53.1 Synopsis

```
qrun [-a] [-H <vnode specification> ] <job ID> [<job ID> ...]
```

```
qrun [-a] [-H - ] <job ID> [<job ID> ...]
```

```
qrun --version
```

### 2.53.2 Description

Forces a job to run, regardless of scheduling position or resource requirements.

The `qrun` command can be used on jobs, subjobs, or ranges of subjobs, but not on job arrays. When it is used on a range of subjobs, the non-running subjobs in that range are run.

When preemption is enabled, a scheduler preempts other jobs in order to run this job. Running a job via `qrun` gives the job higher preemption priority than any of the priorities defined in the `preempt_prio` scheduler parameter. See ["Using Preemption" on page 182 in the PBS Professional Administrator's Guide](#).

#### 2.53.2.1 Required Privilege

In order to execute `qrun`, you must have PBS Operator or Manager privilege.

#### 2.53.2.2 Caveats for qrun

- The job is run without respect for limits, primetime, or dedicated time.
- If you use a `-H <vnode specification>` option to run a job, but specify insufficient vnodes or resources, the job may not run correctly. Avoid using this option unless you are sure.
- If you don't use the `-H` option, the job must be in the *Queued* state and reside in an execution queue.
- If you do use the `-H` option, the job must be in the *Queued* or *Suspended* state and reside in an execution queue.
- The `qrun` command cannot be used on a job that is in the process of provisioning.
- If you use the `-H` option, all schedulers are bypassed, and partition boundaries are ignored.
- If you use `qrun` on a subjob, PBS will try to run the subjob regardless of whether the job has hit the limit specified in `max_run_subjobs`.

### 2.53.3 Options to qrun

`-a`

The `qrun` command exits before the job actually starts execution.

**(no -H option)**

The job is run immediately regardless of scheduling policy as long as the following are true:

- The queue in which the job resides is an execution queue.
- Either the resources required by the job are available, or preemption is enabled and the required resources can be made available by preempting jobs that are running.

The `qrun` command by itself, with no `-H` option, overrides the following:

- Limits on resource usage by users, groups, and projects
- Limits on the number of jobs that can be run at a vnode
- Boundaries between primetime and non-primetime, specified in `backfill_prime`
- Whether the job is in a primetime queue: you can run a job in a primetime slot even when it's not primetime, or vice versa. Primetime boundaries are not honored.
- Dedicated time: you can run a job in a dedicated time slot, even if it's not in a dedicated time queue, and vice versa. However, dedicated time boundaries are still honored.

The `qrun` command by itself, with no `-H` option, does not override the following:

- Server and queue resource usage limits

**(with -H option)**

Do **NOT** use this option unless you know exactly what you are doing.

With the `-H` option, all scheduling policies are bypassed and the job is run directly. The job is run immediately on the named or previously-assigned vnodes, regardless of current usage on those vnodes or which scheduler manages those vnodes, with the exception of vnode state. The job is not run and the `qrun` request is rejected if any named vnode is down, already allocated exclusively, or would need to be allocated exclusively and another job is already running on the vnode. The job is run if the vnode is *offline*.

The `-H` option runs jobs that are queued or suspended.

If the `qrun -H` command is used on a job that requests an AOE, and that AOE is not instantiated on those vnodes, the vnodes are provisioned with the AOE.

If the job requests an AOE, and that AOE is not available on the specified vnodes, the job is held.

**-H <vnode specification without resources>**

The *vnode specification without resources* has this format:

`(<vchunk>)[+(<vchunk>) ...]`

where *vchunk* has the format

`<vnode name>[+<vnode name> ...]`

Example:

`-H (VnodeA+VnodeB)+(VnodeC)`

PBS applies one requested chunk from the job's selection directive in round-robin fashion to each *vchunk* in the list. Each *vchunk* must be sufficient to run the job's corresponding chunk, otherwise the job may not execute correctly.

**-H <vnode specification with resources>**

The *vnode specification with resources* has this format:

(<vchunk>)[+(<vchunk>) ...]

where *vchunk* has the format

<vnode name>:<vnode resources>[+<vnode name>:<vnode resources> ...]

and where *vnode resources* has the format

<resource name>=<value>[:<resource name>=<value> ...]

Example:

```
-H (VnodeA:mem=100kb:ncpus=1) +(VnodeB:mem=100kb:ncpus=2+VnodeC:mem=100kb)
```

PBS creates a new selection directive from the *vnode specification with resources*, using it instead of the original specification from the user. Any single resource specification results in the job's original selection directive being ignored. Each *vchunk* must be sufficient to run the job's corresponding chunk, otherwise the job may not execute correctly.

If the job being run requests `-l place=exclhost`, take extra care to satisfy the `exclhost` request.

Make sure that if any vnodes are from a multi-vnoded host, all vnodes from that host are allocated. Otherwise those vnodes can be allocated to other jobs.

**-H -**

Runs the job on the set of resources to which it is already assigned. You can run a job on the set of resources already assigned to the job, without having to list the resources, by using the `-` (dash) argument to the `-H` option.

**--version**

The `qrun` command returns its PBS version information and exits. This option can only be used alone.

## 2.53.4 Operands

**Job ID**

The `qrun` command accepts a list of job IDs, of the form:

<sequence number>[.<server name>][@<server name>]

<sequence number>[<index>][.<server name>][@<server name>]

<sequence number>[<index start>-<index end>][.<server name>][@<server name>]

Note that some shells require that you enclose a job array identifier in double quotes.

**vnode specification**

The *vnode specification without resources* has this format:

`(<vchunk>)[+(<vchunk>) ...]`

where *vchunk* has the format

`<vnode name>[+<vnode name> ...]`

Example:

`-H (VnodeA+VnodeB)+(VnodeC)`

The *vnode specification with resources* has this format:

`(<vchunk>)[+(<vchunk>) ...]`

where *vchunk* has the format

`<vnode name>:<vnode resources>[+<vnode name>:<vnode resources> ...]`

and where *vnode resources* has the format

`<resource name>=<value>[:<resource name>=<value> ...]`

Example:

`-H (VnodeA:mem=100kb:ncpus=1) +(VnodeB:mem=100kb:ncpus=2+VnodeC:mem=100kb)`

A *vnode name* is the name of the vnode, not the name of the host.

**2.53.5 Standard Error**

The `qrun` command writes a diagnostic message to standard error for each error occurrence.

**2.53.6 Exit Status**

Zero

On success

Greater than zero

If the `qrun` command fails to process any operand

**2.53.7 See Also**

The PBS Professional Administrator's Guide

## 2.54 qselect

Selects specified PBS jobs

### 2.54.1 Synopsis

```
qselect [-a [<op>] <date and time>] [-A <account string>] [-c [<op>] <interval>] [-h <hold list>] [-H] [-J] [-l
    <resource list>] [-N <name>] [-p [<op>] <priority>] [-P <project>] [-q <destination>] [-r <rerun>] [-s
    <states>] [-t <time option> [<comparison>] <specified time>] [-T] [-u <user list>] [-x]
```

```
qselect --version
```

### 2.54.2 Description

The `qselect` command lists those jobs that meet the specified selection criteria. You can compare certain job attribute values to specified values using a comparison operator shown as *op* in the option description.

You can select jobs, job arrays, or subjobs. You can select jobs from one server per call to the command.

Each option acts as a filter restricting which jobs are listed.

You can select jobs according to the values of some of the resources in the `Resource_List` job attribute. You can also select jobs according the selection directive (although because this is a string, you can only check for equality or inequality.)

Jobs that are finished or moved are listed only when the `-x` or `-H` options are used. Otherwise, job selection is limited to queued and running jobs.

#### 2.54.2.1 Comparison Operations

You can select jobs by comparing the values of certain job attributes to values you specify. The following table lists the comparison operations you can use:

**Table 2-23: Comparison Operations**

| Operation         | Type of Comparison   |
|-------------------|--|
| <code>.eq.</code> | The value of the job attribute is equal to the value of the option argument.                 |
| <code>.ne.</code> | The value of the job attribute is not equal to the value of the option argument.             |
| <code>.ge.</code> | The value of the job attribute is greater than or equal to the value of the option argument. |
| <code>.gt.</code> | The value of the job attribute is greater than the value of the option argument.             |
| <code>.le.</code> | The value of the job attribute is less than or equal to the value of the option argument.    |
| <code>.lt.</code> | The value of the job attribute is less than the value of the option argument.                |

For example, to select jobs whose `Priority` attribute has a value greater than 5:

```
qselect -p.gt.5
```

Where an optional comparison is not specified, the comparison operation defaults to `.eq.`, meaning PBS checks whether the value of the attribute is equal to the option argument.

### 2.54.2.2 Required Permissions

When selecting jobs according to resource values, users without operator or manager privilege cannot specify custom resources which were created to be invisible to unprivileged users.

### 2.54.3 Options to `qselect`

(no options)

Lists all jobs at the server which the user is authorized to list (query status of).

**-a [*<op>*] *<date and time>***

**Deprecated.** Restricts selection to those jobs whose `Execution_Time` attribute qualifies when compared to the *date and time* argument. You can select a range of execution times by using this option twice, to compare to a minimum time and a maximum time.

The *date and time* argument has the format:

`[[CC]YY]MMDDhhmm[.SS]`

where *MM* is the two digits for the month, *DD* is the day of the month, *hh* is the hour, *mm* is the minute, and the optional *SS* is the seconds. *CC* is the century and *YY* the year.

**-A *<account string>***

Restricts selection to jobs whose `Account_Name` attribute matches the specified *account string*.

**-c [*<op>*] *<interval>***

Restricts selection to jobs whose `Checkpoint` interval attribute meets the comparison criteria.

The *interval* argument can take one of the following values:

*c*

*c=<minutes>*

*n*

*s*

*w*

*w=<minutes>*

We give the range of interval values for the `Checkpoint` attribute the following ordered relationship:

$n > s > c=<minutes> > c > u$

(Information about *w* and *w=<minutes>* is not available.)

For an interval value of "*u*", only ".eq." and ".ne." are valid.

**-h <hold list>**

Restricts the selection of jobs to those with a specific set of hold types. The holds in the `Hold_Types` job attribute must be the same as those in the *hold list* argument, but can be in a different order.

The *hold list* argument is a string consisting of the single letter *n*, or one or more of the letters *u*, *o*, *p*, or *s* in any combination. If letters are duplicated, they are treated as if they occurred once. The letters represent the hold types:

**Table 2-24: Hold Types**

| Letter   | Hold Type    |
|----------|--------------|
| <i>n</i> | None         |
| <i>u</i> | User         |
| <i>o</i> | Other        |
| <i>p</i> | Bad password |
| <i>s</i> | System       |

**-H**

Restricts selection to finished and moved jobs.

**-J**

Limits selection to job arrays only.

**-l <resource list>**

Restricts selection of jobs to those with specified resource amounts. Resource must be job-wide, or be `mem`, `ncpus`, or `vmem`.

The *resource list* is in the following format:

`<resource name> <op> <value>[,<resource name> <op> <value> ...]`

You must specify *op*, and you can use any of the comparison operators.

Because resource specifications for chunks using the `select` statement, and placement using the `place` statement, are stored as strings, the only useful operators for these are `.eq.` and `.ne.`

Unprivileged users cannot specify custom resources which were created to be invisible to unprivileged users.

**-N <name>**

Restricts selection of jobs to those with the specified value for the `Job_Name` attribute.

**-p [<op>]<priority>**

Restricts selection of jobs to those with the specified Priority value(s).

**-P <project>**

Restricts selection of jobs to those matching the specified value for the `project` attribute.

Format: *Project Name*; see ["Project Name" on page 361](#)

**-q <destination>**

Restricts selection to those jobs at the specified *destination*.

The *destination* may take of one of the following forms:

`<queue name>`

Restricts selection to the specified queue at the default server.

`@<server name>`



Restricts selection to the specified server.

`<queue name>@<server name>`

Restricts selection to the specified queue at the specified server.

If the `-q` option is not specified, jobs are selected from the default server.

**-r <rerun>**

Restricts selection of jobs to those with the specified value for the `Rerunable` attribute . The option argument *rerun* must be a single character, either *y* or *n* .

**-s <states>**

Restricts job selection to those whose `job_state` attribute has the specified value(s).

The *states* argument is a character string consisting of any combination of these characters: *B*, *E*, *F*, *H*, *M*, *Q*, *R*, *S*, *T*, *U*, *W*, and *X*. (A repeated character is accepted, but no additional meaning is assigned to it.)

**Table 2-25: Job States**

| State    | Meaning  |
|----------|--|
| <i>B</i> | Job array has started execution                |
| <i>E</i> | The <i>Exiting</i> state                       |
| <i>F</i> | The <i>Finished</i> state                      |
| <i>H</i> | The <i>Held</i> state                          |
| <i>M</i> | The <i>Moved</i> state                         |
| <i>Q</i> | The <i>Queued</i> state                        |
| <i>R</i> | The <i>Running</i> state                       |
| <i>S</i> | The <i>Suspended</i> state                     |
| <i>T</i> | The <i>Transiting</i> state                    |
| <i>U</i> | Job suspended due to workstation user activity |
| <i>W</i> | The <i>Waiting</i> state                       |
| <i>X</i> | The <i>Exited</i> state. Subjobs only          |

Jobs in any of the specified states are selected.

Job arrays are never in states *R*, *S*, *T*, or *U*. Subjobs may be in those states.

**-t <time option> [<op>] <specified time>**

Jobs are selected according to one of their time-based attributes. The *time option* specifies which time-based attribute is tested. You give the *specified time* in *datetime* format. See [Chapter 7, "Formats", on page 357](#).

The *time option* is one of the following:

**Table 2-26: Sub-options to the -t Option**

| Time Option | Time Attribute       | Option Format(s)   | Attribute Description   |
|-------------|----------------------|--|---|
| <i>a</i>    | Execution_Time       | <i>Timestamp</i><br>Use <i>datetime</i> format to specify.   | Time at which the job is eligible for execution.  |
| <i>c</i>    | ctime                | <i>Timestamp</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch.                    | Time at which the job was created.  |
| <i>e</i>    | etime                | <i>Timestamp</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch.                    | Time when job became eligible to run, i.e. was enqueued in an execution queue and was in the "Q" state. Reset when a job moves queues, or is held then released. Not affected by qaltering. |
| <i>g</i>    | eligible_time        | Use <i>duration</i> format to specify.   | Amount of eligible time job accrued waiting to run.   |
| <i>m</i>    | mtime                | <i>Timestamp</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch.                    | Time that the job was last modified, changed state, or changed locations.   |
| <i>q</i>    | qtime                | <i>Timestamp</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch.                    | Time that the job entered the current queue.  |
| <i>s</i>    | stime                | <i>Timestamp</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch.                    | Time the job started. Updated when job is restarted.  |
| <i>t</i>    | estimated.start_time | Use <i>datetime</i> format to specify. Printed by <code>qstat</code> in human-readable <i>Date</i> format. Output in hooks as seconds since epoch. | Job's estimated start time.   |

To bracket a time period, use the `-t` option twice. For example, to select jobs using **stime** between noon and 3 p.m.:

```
qselect -ts.gt.09251200 -ts.lt.09251500
```

**-T**

Limits selection to jobs and subjobs.

**-u <user list>**

Restricts selection to jobs owned by the specified usernames.

Syntax of *user list*:

*<username>[@<hostname>][,<username>[@<hostname>],...]*

Selects jobs which are owned by the listed users at the corresponding hosts. Hostnames may be wildcarded on the left end, e.g. `"*.nasa.gov"`. A username without a `"@<hostname>"` is equivalent to `"<username>@*"`, meaning that it is valid at any host.

**-X**

Selects finished and moved jobs in addition to queued and running jobs.

**--version**

The `qselect` command returns its PBS version information and exits. This option can only be used alone.

## 2.54.4 Standard Output

PBS writes a list of the selected job IDs to standard output. Each job ID is separated by white space. A job ID can represent a job, a job array, or a subjob. Each job ID has one of the forms:

*<sequence number>.<server name>[@<server name>]*

*<sequence number>[.<server name>[@<server name>]*

*<sequence number>[<index>].<server name>[@<server name>]*

*@<server name>* identifies the server which currently owns the job.

## 2.54.5 Standard Error

The `qselect` command writes a diagnostic message to standard error for each error occurrence.

## 2.54.6 Exit Status

**Zero**

Upon successful processing of all options presented to the `qselect` command

**Greater than zero**

If the `qselect` command fails to process any option

## 2.54.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, [section 6.11, "Job Attributes", on page 332](#), [Chapter 5, "List of Built-in Resources", on page 265](#)

## 2.55 qsig

Send signal to PBS job

### 2.55.1 Synopsis

```
qsig [-s <signal>] <job ID> [<job ID> ...]
```

```
qsig --version
```

### 2.55.2 Description

The `qsig` command sends a signal to all the processes of the specified job(s). The `qsig` command sends a Signal Job batch request to the server which owns the job.

The `qsig` command can be used for jobs, job arrays, subjobs, and ranges of subjobs. If it is used on a range of subjobs, the running subjobs in the range are signaled.

Not all signal names are recognized by `qsig`; if using a signal name does not work, try issuing the signal number instead.

#### 2.55.2.1 Using admin-suspend and admin-resume

If you have a vnode requiring maintenance while remaining powered up, where you don't want jobs running during the maintenance, you can use the special signals *admin-suspend* and *admin-resume* to suspend and resume the jobs on the vnode. When you use *admin-suspend* on a vnode's job(s), the vnode goes into the *maintenance* state, and its scheduler does not schedule jobs on it. You must separately *admin-suspend* each job on the vnode. When its last *admin-suspended* job is *admin-resumed*, a vnode leaves the *maintenance* state.

#### 2.55.2.2 Restrictions

The request to signal a job is rejected if:

- The user is not authorized to signal the job
- The job is not in the *running* or *suspended* state
- The requested signal is not supported by the system upon which the job is executing
- The job is in the process of provisioning
- You attempt to use *admin-resume* on a job that was *suspended*
- You attempt to use *resume* on a job that was *admin-suspended*

#### 2.55.2.3 Required Privilege

Manager or Operator privilege is required to use the *admin-suspend*, *admin-resume*, *suspend*, or *resume* signals. Unprivileged users can use other signals.

### 2.55.3 Options to qsig

(no options)

PBS sends SIGTERM to the job.

**-s <signal>**

PBS sends signal *signal* to the job.

**--version**

The `qsig` command returns its PBS version information and exits. This option can only be used alone.

### 2.55.3.1 Signals

You can send standard signals to a job, or the special signals described below. The *signal* argument can be in any of the following formats:

- A signal name, e.g. *SIGKILL*
- A signal name without the SIG prefix, e.g. *KILL*
- An unsigned signal number, e.g. *9*

The signal name *SIGNULL* is allowed; in this case the server sends the signal 0 to the job, which has no effect.

#### 2.55.3.1.i Special Signals

The following special signals are all lower-case, and have no associated signal number:

##### admin-suspend

Suspends a job and puts its vnodes into the *maintenance* state. The job is put into the *S* state and its processes are suspended. When suspended, a job is not executing and is not charged for walltime.

Syntax: `qsig -s admin-suspend <job ID>`

##### admin-resume

Resumes a job that was suspended using the *admin-suspend* signal, without waiting for its scheduler. Cannot be used on jobs that were suspended with the *suspend* signal. When the last *admin-suspended* job has been *admin-resumed*, the vnode leaves the maintenance state.

Syntax: `qsig -s admin-resume <job ID>`

##### suspend

Suspends specified job(s). Job goes into *suspended (S)* state. When suspended, a job is not executing and is not charged for walltime.

##### resume

Marks specified job(s) for resumption by its scheduler when there are sufficient resources. If you use `qsig -s resume` on a job that was suspended using `qsig -s suspend`, the job is resumed when there are sufficient resources. Cannot be used on jobs that were suspended with the *admin\_suspend* signal.

## 2.55.4 Operands

The `qsig` command accepts one or more *job ID* operands. For a job, this has the form:

`<sequence number>[.<server name>][@<server name>]`

For a job array, *job ID* takes this form:

`<sequence number>[[.<server name>][@<server name>]`

Note that some shells require that you enclose a job array identifier in double quotes.

## 2.55.5 Standard Error

The `qsig` command writes a diagnostic message to standard error for each error occurrence.

## 2.55.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qsig` command

### Greater than zero

If the `qsig` command fails to process any operand

## 2.55.7 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide

---

## 2.56 qstart

Turns on scheduling or routing for the jobs in a PBS queue

### 2.56.1 Synopsis

```
qstart <destination> [<destination> ...]
```

```
qstart --version
```

### 2.56.2 Description

If *destination* is an execution queue, the `qstart` command allows a PBS scheduler to schedule jobs residing in the specified queue. If *destination* is a routing queue, the server can begin routing jobs from that queue. Sets the value of the queue's `started` attribute to *True*.

#### 2.56.2.1 Required Privilege

In order to execute `qstart`, you must have PBS Operator or Manager privilege.

### 2.56.3 Options

`--version`

The `qstart` command returns its PBS version information and exits. This option can only be used alone.

### 2.56.4 Operands

The `qstart` command accepts one or more space-separated *destination* operands. The operands take one of three forms:

`<queue name>`

Starts scheduling or routing from the specified queue.

`@<server name>`

Starts scheduling or routing from all queues at the specified server.

`<queue name>@<server name>`

Starts scheduling or routing from the specified queue at the specified server.

To start scheduling at all queues at the default server, use the `qmgr` command:

```
Qmgr: set queue @default started=true
```

### 2.56.5 Standard Error

The `qstart` command writes a diagnostic message to standard error for each error occurrence.

## 2.56.6 Exit Status

### Zero

Upon successful processing of all the operands presented to the `qstart` command

### Greater than zero

If the `qstart` command fails to process any operand

## 2.56.7 See Also

The PBS Professional Administrator's Guide, ["qmgr" on page 157](#), ["qstop" on page 219](#)



## 2.57 qstat

Displays status of PBS jobs, queues, or servers

### 2.57.1 Synopsis

#### 2.57.1.1 Displaying Job Status

Default format:

```
qstat [-E] [-J] [-j] [-p] [-t] [-w] [-x] [[<job ID> | <destination>] ...]
```

Long format:

```
qstat -f [-F json|dsv [-D <delimiter>]] [-E] [-J] [-j] [-p] [-t] [-w] [-x] [[<job ID list> | <destination>] ...]
```

Alternate format:

```
qstat [-a | -H | -i | -r ] [-E] [-G | -M] [-J] [-j] [-n [-l]] [-s [-l]] [-t] [-T] [-u <user list>] [-w] [[<job ID> | <destination>] ...]
```

#### 2.57.1.2 Displaying Queue Status

Default format:

```
qstat -Q [<destination> ...]
```

Long format:

```
qstat -Q -f [-F json|dsv [-D <delimiter>]] [-w] [<destination> ...]
```

Alternate format:

```
qstat -q [-G | -M] [<destination> ...]
```

#### 2.57.1.3 Displaying Server Status

Default format:

```
qstat -B [<server name> ...]
```

Long format:

```
qstat -B -f [-F json|dsv [-D <delimiter>]] [-w] [<server name> ...]
```

#### 2.57.1.4 Displaying Version Information

```
qstat --version
```

### 2.57.2 Description

The `qstat` command displays the status of jobs, queues, or servers, writing the status information to standard output.

When displaying job status information, the `qstat` command displays status information about all specified jobs, job arrays, and subjobs. You can specify jobs by ID, or by destination, for example all jobs at a specified queue or server.

### 2.57.2.1 Display Formats

You can use particular options to display status information in a default format, an alternate format, or a long format. Default and alternate formats display all status information for a job, queue, or server with one line per object, in columns. Long formats display status information showing all attributes, one attribute to a line.

### 2.57.2.2 Displaying Information for Finished and Moved Jobs

You can display status information for finished and moved jobs by using the `-x` and `-H` options.

If your job has been moved to another server through peer scheduling, give the job ID as an argument to `qstat`. If you do not specify the job ID, your job will not appear to exist. For example, your job 123.ServerA is moved to ServerB. In this case, you can use:

```
qstat 123
```

or

```
qstat 123.ServerA
```

Specifying the full job name, including the server, avoids the possibility that `qstat` will report on a job named 123.ServerB that was moved to ServerA.

To list all jobs at ServerB, you can use:

```
qstat @ServerB
```

### 2.57.2.3 Displaying Truncated Data

When the number of characters required would exceed the space available, `qstat` truncates the output and puts an asterisk ("\*") in the last position. For example, in default job display format, there are three characters allowed for the number of cores. If the actual output were 1234, the value displayed would be 12\* instead.

### 2.57.2.4 Avoiding False Returns when Using `qselect`

If you use the output of `qselect` as the input to `qstat`, and `qselect` returns no job IDs, by default `qstat` treats that as a request for status of all jobs. To avoid this, use the `-j` option to `qstat`.

### 2.57.2.5 Required Privilege

Users without Manager or Operator privilege cannot view resources or attributes that are invisible to unprivileged users.

## 2.57.3 Displaying Job Status

### 2.57.3.1 Job Status in Default Format

Triggers: no options, or any of the `-J`, `-p`, `-t`, or `-x` options.

The `qstat` command displays job status in default format when you specify no options, or any of the `-J`, `-p`, `-t`, or `-x` options. Jobs are displayed one to a line, with these column headers:

```
Job id   Name       User       Time Use S Queue
-----
```

Description of columns:

**Table 2-27: Description of Default Job Status Columns**

| Column                             | Width without -w   | Width with -w | Description  |
|------------------------------------|--|---------------|--|
| Job ID                             | 17 (22 when <code>max_job_sequence_id</code> > 10 million) | 30            | Job ID assigned by PBS   |
| Name                               | 16   | 15            | Job name specified by submitter  |
| User                               | 16   | 15            | Username of job owner  |
| Time Use<br>or<br>Percent Complete | 8  | 8             | <p>The CPU time used by the job. Before the application has actually started running, for example during stage-in, this field is "0". At the point where the application starts accumulating <code>cpus</code>, this field changes to "00:00:00". After that, every time the MoM polls for resource usage, the field is updated.</p> <p>The MoM on each execution host polls for the usage of all processes on her host belonging to the job. Usage is summed. The polling interval is short when a job first starts running and lengthens to a maximum of 2 minutes. See <a href="#">"Configuring MoM Polling Cycle" on page 40 in the PBS Professional Administrator's Guide</a>.</p> <p>If you specify <code>-p</code>, the <i>Time Use</i> column is replaced with the percentage completed for the job. For a job array this is the percentage of subjobs completed. For a normal job, it is the percentage of allocated CPU time used.</p> |
| S                                  | 1  | 1             | The job's state. See <a href="#">section 8.1, "Job States", on page 365</a>  |
|                                    |  |               | <i>B</i> Array job has at least one subjob running   |
|                                    |  |               | <i>E</i> Job is exiting after having run   |
|                                    |  |               | <i>F</i> Job is finished   |
|                                    |  |               | <i>H</i> Job is held   |
|                                    |  |               | <i>M</i> Job was moved to another server   |
|                                    |  |               | <i>Q</i> Job is queued   |
|                                    |  |               | <i>R</i> Job is running  |
|                                    |  |               | <i>S</i> Job is suspended  |
|                                    |  |               | <i>T</i> Job is being moved to new location  |
|                                    |  |               | <i>U</i> Cycle-harvesting job is suspended due to keyboard activity  |
|                                    |  |               | <i>W</i> Job is waiting for its submitter-assigned start time to be reached  |
|                                    |  |               | <i>X</i> Subjob has completed execution or has been deleted  |
| Queue                              | 16   | 15            | The queue in which the job resides   |

### 2.57.3.2 Job Status in Long Format

Trigger: the `-f` option.

If you specify the `-f` (full) option, full job status information for each job is displayed in this order:

- The job ID
- Each job attribute, one to a line
- The job's submission arguments
- The job's executable, in JSDL format
- The executable's argument list, in JSDL format

The job attributes are listed as `<name> = <value>` pairs. This includes the `exec_host` and `exec_vnode` strings. The full output can be very large.

The `exec_host` string has this format:

```
<host1>/<T1>*<P1>[+<host2>/<T2>*<P2>+...]
```

where

`T1` is the task slot number (the index) of the job on `host1`.

`P1` is the number of processors allocated to the job from `host1`. The number of processors allocated does not appear if it is 1.

The `exec_vnode` string has the format:

```
(<vnode1>:ncpus=<N1>:mem=<M1>)[+(<vnode2>:ncpus=<N2>:mem=<M2>)+...]
```

where

`N1` is the number of CPUs allocated to that job on `vnode1`.

`M1` is the amount of memory allocated to that job on `vnode1`.

### 2.57.3.3 Job Status in Alternate Format

Triggers: any of the `-a`, `-i`, `-G`, `-H`, `-M`, `-n`, `-r`, `-s`, `-T`, or `-u <user list>` options.

The `qstat` command displays job status in alternate format if you specify any of the `-a`, `-i`, `-G`, `-H`, `-M`, `-n`, `-r`, `-s`, `-T`, or `-u <user list>` options. Jobs are displayed one to a line. If jobs are running and the `-n` option is specified, or if jobs are finished or moved and the `-H` and `-n` options are specified, there is a second line for the `exec_host` string.

#### 2.57.3.3.i Job Status Alternate Format Output Columns

Alternate format job status output contains the following columns:

|        |          |       |         |        |     |     |        | Req'd | Req'd | Elap |
|--------|----------|-------|---------|--------|-----|-----|--------|-------|-------|------|
| Job ID | Username | Queue | Jobname | SessID | NDS | TSK | Memory | Time  | S     | Time |
| -----  | -----    | ----- | -----   | -----  | --- | --- | -----  | ----- | -     | ---- |

Description of columns:

**Table 2-28: Description of Alternate Format Job Status Columns**

| Column                            | Width without -w   | Width with -w | Description  |
|-----------------------------------|--|---------------|--|
| Job ID                            | 15 (20 when <code>max_job_sequence_id</code> > 10 million) | 30            | The job ID assigned by PBS   |
| Username                          | 8  | 15            | Username of job owner  |
| Queue                             | 8  | 15            | Queue in which the job resides   |
| Jobname                           | 10   | 15            | Job name specified by submitter  |
| SessID                            | 6  | 8             | Session ID. Appears only if the job is running   |
| NDS                               | 3  | 4             | Number of chunks or vnodes requested by the job  |
| TSK                               | 3  | 5             | Number of CPUs requested by the job  |
| Req'd Memory                      | 6  | 6             | Amount of memory requested by the job  |
| Req'd Time                        | 5  | 5             | If CPU time is requested, shows CPU time. Otherwise, shows walltime  |
| S                                 | 1  | 1             | The job's state; see <a href="#">"States" on page 365</a> for states   |
| Elap Time<br>or<br>Est Start Time | 5  | 5             | If CPU time is requested, shows CPU time. Otherwise, shows walltime.<br><br>If you use the <code>-P</code> option, displays estimated start time for queued jobs, replacing the <i>Elap Time</i> field with the <i>Est Start Time</i> field. |

### 2.57.3.4 Grouping Jobs and Sorting by ID

Trigger: the `-E` option.

You can use the `-E` option to sort and group jobs in the output of `qstat`. The `-E` option groups jobs by server and displays each group by ascending ID. This option also improves `qstat` performance. The following table shows how the `-E` option affects the behavior of `qstat`:

**Table 2-29: How -E Option Affects qstat Output**

| How <code>qstat</code> is Used                                | Result Without <code>-E</code>                   | Result With <code>-E</code>                                   |
|---|--|---|
| <code>qstat</code> (no job ID specified)                      | Queries the default server and displays result   | No change in behavior; same as without <code>-E</code> option |
| <code>qstat &lt;list of job IDs from single server&gt;</code> | Displays results in the order specified          | Displays results in ascending ID order                        |
| <code>qstat &lt;job IDs at multiple servers&gt;</code>        | Displays results in the order they are specified | Groups jobs by server. Displays each group in ascending order |

## 2.57.4 Displaying Queue Status

### 2.57.4.1 Queue Status in Default Format

Trigger: the `-Q` option by itself.

The `qstat` command displays queue status in default format if the only option is `-Q`. Queue status is displayed one queue to a line, with these column headers:

```
Queue      Max Tot Ena Str Que Run Hld Wat Trn Ext Type
-----
```

Description of columns:

**Table 2-30: Description of Default Queue Status Columns**

| Column | Description  |
|--------|--|
| Queue  | Queue name   |
| Max    | Maximum number of jobs allowed to run concurrently in this queue |
| Tot    | Total number of jobs in the queue                                |
| Ena    | Whether the queue is enabled or disabled                         |
| Str    | Whether the queue is started or stopped                          |
| Que    | Number of queued jobs  |
| Run    | Number of running jobs   |
| Hld    | Number of held jobs  |
| Wat    | Number of waiting jobs   |
| Trn    | Number of jobs being moved (transiting)                          |
| Ext    | Number of exiting jobs   |
| Type   | Type of queue: execution or routing                              |

### 2.57.4.2 Queue Status in Long Format

Trigger: the `-Q` and `-f` options together.

If you specify the `-f` (full) option with the `-q` option, full queue status information for each queue is displayed starting with the queue name, followed by each attribute, one to a line, as `<name> = <value>` pairs.

#### 2.57.4.2.i Queue Status: Alternate Format

Triggers: any of the `-q`, `-G`, or `-M` options.

The `qstat` command displays queue status in the alternate format if you specify any of the `-q`, `-G`, or `-M` options. Queue status is displayed one queue to a line, and the lowest line contains totals for some columns.

These are the alternate format queue status column headers:

```
Queue  Memory CPU Time Walltime Node Run Que Im State
-----
```

Description of columns:

**Table 2-31: Description of Queue Alternate Status Columns**

| Column   | Description  |
|----------|--|
| Queue    | Queue name   |
| Memory   | Maximum amount of memory that can be requested by a job in this queue  |
| CPU Time | Maximum amount of CPU time that can be requested by a job in this queue  |
| Walltime | Maximum amount of walltime that can be requested by a job in this queue  |
| Node     | Maximum number of vnodes that can be requested by a job in this queue  |
| Run      | Number of running and suspended jobs. Lowest row is total number of running and suspended jobs in all the queues shown         |
| Que      | Number of queued, waiting, and held jobs. Lowest row is total number of queued, waiting, and held jobs in all the queues shown |
| Lm       | Maximum number of jobs allowed to run concurrently in this queue   |
| State    | State of this queue: <i>E</i> (enabled) or <i>D</i> (disabled), and <i>R</i> (running) or <i>S</i> (stopped)                   |

## 2.57.5 Displaying Server Status

### 2.57.5.1 Server Status in Default Format:

Trigger: the `-B` option.

The `qstat` command displays server status if the only option given is `-B`.

Column headers for default server status output:

```

Server  Max  Tot  Que  Run  Hld  Wat  Trn  Ext  Status
-----

```

Description of columns:

**Table 2-32: Description of Server Status Default Display Columns**

| Column | Description   |
|--------|---|
| Server | Name of server  |
| Max    | Maximum number of jobs allowed to be running concurrently on the server |
| Tot    | Total number of jobs currently managed by the server                    |
| Que    | Number of queued jobs   |
| Run    | Number of running jobs  |
| Hld    | Number of held jobs   |
| Wat    | Number of waiting jobs  |

Table 2-32: Description of Server Status Default Display Columns

| Column | Description               |
|--------|---------------------------|
| Trn    | Number of transiting jobs |
| Ext    | Number of exiting jobs    |
| Status | Status of the server      |

### 2.57.5.2 Server Status in Long Format

Trigger: the `-f` option.

If you specify the `-f` (full) option, displays full server status information starting with the server name, followed by each server attribute, one to a line, as `<name> = <value>` pairs. Includes PBS version information.

## 2.57.6 Options to `qstat`

### 2.57.6.1 Generic Job Status Options

`-E`

Groups jobs by server and displays jobs sorted by ascending ID. When `qstat` is presented with a list of jobs, jobs are grouped by server and each group is displayed by ascending ID. This option also improves `qstat` performance. See [section 2.57.3.4, “Grouping Jobs and Sorting by ID”, on page 209](#).

`-j`

Prevents an empty input to `qstat` from returning status of all jobs.

For use when a blank input to `qstat` should not return status of all jobs.

### 2.57.6.2 Default Job Status Options

The following options cause job status information to be displayed in default format:

`-J`

Displays status information for job arrays (not subjobs). When used with the `-t` option, displays status information for subjobs only.

`-t`

Displays status information for jobs, job arrays, and subjobs. When used with `-J` option, displays status information for subjobs only.

`-p`

The *Time Use* column is replaced with the percentage completed for the job. For a job array this is the percentage of subjobs completed. For a normal job, it is the percentage of allocated CPU time used.

`-x`

Displays status information for finished and moved jobs in addition to queued and running jobs.

### 2.57.6.3 Alternate Job Status Options

The following options cause job status information to be displayed in alternate format:



---

**-a**

All queued and running jobs are displayed. If a *destination* is specified, information for all jobs at that *destination* is displayed. If a *job ID* is specified, information about that job is displayed. When using this option with the **-n** or **-s** options, always specify this option before the **-n** or **-s** options, otherwise they will not take effect.

**-H**

Without a job identifier, displays information for all finished or moved jobs. If a *job ID* is given, displays information for that job regardless of its state. If a *destination* is specified, displays information for finished or moved jobs, or specified job(s), at *destination*.

**-i**

If a *destination* is given, information for queued, held or waiting jobs at that *destination* is displayed. If a *job ID* is given, information about that job is displayed regardless of its state.

**-n**

The `exec_host` string is listed on the line below the basic information. If the **-1** option is given, the `exec_host` string is listed on the end of the same line. If using the **-a** option with this option, always specify the **-n** option after **-a**, otherwise the **-n** option does not take effect.

**-r**

If a *destination* is given, information for running or suspended jobs at that *destination* is displayed. If a *job ID* is given, information about that job is displayed regardless of its state.

**-s**

Any comment added by the administrator or scheduler is shown on the line below the basic information. If the **-1** option is given, the comment string is listed on the end of the same line. If using the **-a** option with this option, always specify the **-s** option after **-a**, otherwise the **-s** option does not take effect.

**-T**

Displays estimated start time for queued jobs, replacing the *Elap Time* field with the *Est Start Time* field. Jobs with earlier estimated start times are displayed before those with later estimated start times.

Running jobs are displayed before other jobs. Running jobs are sorted by their *stime* attribute (start time).

Queued jobs whose estimated start times are unset (*estimated.start\_time* = *unset*) are displayed after those with estimated start times, with the unset value shown as a double dash ("--"). Queued jobs with estimated start times in the past are treated as if their estimated start times are unset.

If a job's estimated start time cannot be calculated, the start time is shown as a question mark ("?").

Time displayed is local to the *qstat* command. Current week begins on Sunday.

The following table shows the format for the *Est Start Time* field when the *-w* option is not used:

**Table 2-33: Format for Estimated Start Time Field without *-w* Option**

| Format                  | Job Estimated Start Time                                  | Example |
|-------------------------|---|---------|
| <HH>:<MM>               | Today   | 15:34   |
| <2-letter weekday> <HH> | Within 7 days, but after today                            | We 15   |
| <3-letter month name>   | This calendar year, but after this week                   | Feb     |
| <YYYY>                  | Less than or equal to 5 years from today, after this year | 2018    |
| >5yrs                   | More than 5 years from today                              | >5yrs   |

The following table shows the format for the *Est Start Time* field when the *-w* option is used:

**Table 2-34: Format for Estimated Start Time Field with *-w* Option**

| Format                                     | Job Estimated Start Time       | Example               |
|--|--------------------------------|-----------------------|
| <i>Today</i> <HH>:<MM>                     | Today                          | Today 13:34           |
| <Day> <HH>:<MM>                            | This week, but after today     | Wed 15:34             |
| <Day> <Month> <Daynum><br><HH>:<MM>        | This year, but after this week | Wed Feb 10 15:34      |
| <Day> <Month> <Daynum><br><YYYY> <HH>:<MM> | After this year                | Wed Feb 10 2011 15:34 |

When used with the *-f* option, prints the full timezone-qualified start time.

Estimated start time information can be made unavailable to unprivileged users; in this case, the estimated start time appears to be unset.

**-u <user list>**

If a *destination* is given, status for jobs at that *destination* owned by users in *user list* is displayed. If a *job ID* is given, status information for that job is displayed regardless of the job's ownership.

Format: <username>[@<hostname>][, <username>[@<hostname>], ...] in comma-separated list.

Hostnames may be wildcarded, but not domain names. When no hostname is specified, *username* is for any host.

**-W**

Can be used with job status in default and alternate formats. Allows display of wider fields up to 120 characters. See [section 2.57.3.1, “Job Status in Default Format”, on page 206](#) and [section 2.57.3.3, “Job Status in Alternate Format”, on page 208](#) for column widths.

This option is different from the `-w` option used with the `-f` long-format option.

**-1 (hyphen one)**

Reformats `qstat` output to a single line. Can be used only in conjunction with the `-n` and/or `-s` options.

## 2.57.6.4 Queue Status Options

**-Q**

Displays queue status in default format. Operands must be *destinations*.

**-q**

Displays queue status in alternate format. Operands must be *destinations*.

## 2.57.6.5 Server Status Options

**-B**

Display server status. Operands must be names of servers.

## 2.57.6.6 Job, Queue, and Server Status Options

**-f [-w]**

Full display for long format. Job, subjob, queue, or server attributes displayed one to a line.

JSON output:

PBS reports `resources_used` values for resources that are created or set in a hook as JSON strings in the output of `qstat -f`.

If MoM returns a JSON object (a Python dictionary), PBS reports the value as a string in single quotes:

```
resources_used.<resource_name> = '{ <MoM JSON item value>, <MoM JSON item value>, <MoM JSON item value>, ..}'
```

Example: MoM returns `{ "a":1, "b":2, "c":1, "d": 4}` for `resources_used.foo_str`. We get:

```
resources_used.foo_str='{ "a": 1, "b": 2, "c":1, "d": 4}'
```

If MoM returns a value that is not a valid JSON object, the value is reported verbatim.

Example: MoM returns "hello" for `resources_used.foo_str`. We get:

```
resources_used.foo_str="hello"
```

Optional `-w` prints each attribute on one unbroken line. Feed characters are converted:

- Newline is converted to backslash concatenated with "n", resulting in "\n"
- Form feed is converted to backslash concatenated with "f", resulting in "\f"

This `-w` is independent of the `-w` job output option used with default and alternate formats.

**-F dsv [-D <delimiter>]**

Prints output in delimiter-separated value format. The default *delimiter* is a pipe ("|"). You can specify a character or a string *delimiter* using the -D argument to the -F dsv option. For example, to use a comma as the delimiter:

```
qstat -f -F dsv -D,
```

If the delimiter itself appears in a value, it is escaped:

- On Linux, the delimiter is escaped with a backslash ("\").
- On Windows, the delimiter is escaped with a caret ("^").

Feed characters are converted:

- Newline is converted to backslash concatenated with "n", resulting in "\n"
- Form feed is converted to backslash concatenated with "f", resulting in "\f"

A newline separates each job from the next. Using newline as the delimiter leads to undefined behavior.

Example of getting output in delimiter-separated value format:

```
qstat -f -F dsv
Job Id: 1.vbox|Job_Name = STDIN|Job_Owner = root@vbox|job_state = Q|queue = workq|server =
vbox|Checkpoint = u|ctime = Fri Nov 11 17:57:05 2016|Error_Path = ...
```

**-F json**

Prints output in JSON format (<http://www.json.org/>).

Attribute output is preceded by timestamp, PBS version, and PBS server hostname.

Example:

```
qstat -f -F json
{
  "timestamp":1479277336,
  "pbs_version":"14.1",
  "pbs_server":"vbox",
  "Jobs":{
    "1.vbox":{
      "Job_Name":"STDIN",
      "Job_Owner":"root@vbox",
      "job_state":"Q",
      ...
    }
  }
}
```

**-G**

Shows size in gigabytes. Triggers alternate format.

**-M**

Shows size in megawords. A word is considered to be 8 bytes. Triggers alternate format.

## 2.57.6.7 Version Information

**--version**

The qstat command returns its PBS version information and exits. This option can only be used alone.

## 2.57.7 Operands

### 2.57.7.1 Job Identifier Operands

The *job ID* is assigned by PBS at submission. Job IDs are used only with job status requests. Status information for specified job(s) is displayed.

Input formats:

Job ID:

`<sequence number>[.<server name>][@<server name>]`

Job array ID:

`<sequence number>[[.<server name>][@<server name>]`

Subjob ID:

`<sequence number>[<index>][.<server name>][@<server name>]`

Range of subjobs:

`<sequence number>[<index start>-<index end>][.<server name>][@<server name>]`

Note that some shells require that you enclose a job array identifier in double quotes.

You can use a list of jobs generated as the output of the `qselect` command as the input to the `qstat` command. For example, to get a detailed listing of running jobs:

```
qstat -f $(qselect -s R)
```

### 2.57.7.2 Destination Operands

Name of queue, name of server, or name of queue at a specific server. Formats:

`<queue name>`

Specifies name of queue for job or queue display.

- When displaying job status, PBS displays status for all jobs in the specified queue at the default server.
- When displaying queue status, PBS displays status for the specified queue at the default server.

`<queue name>@<server name>`

Specifies name of queue at server for job or queue display.

- When displaying job status, PBS displays status for all jobs in the specified queue at the specified server.
- When displaying queue status, PBS displays status for the specified queue at the specified server.

`@<server name>`

Specifies server name for job or queue display.

- When displaying job status, PBS displays status for all jobs at all queues at the specified server.
- When displaying queue status, PBS displays status for all queues at the specified server.

`<server name>`

Specifies server name for server display.

- When displaying server status (with the `-B` option) PBS displays status for the specified server.

## 2.57.8 Standard Error

The `qstat` command writes a diagnostic message to standard error for each error occurrence.

## 2.57.9 Exit Status

Zero

Upon successful processing of all operands

Greater than zero

If any operands could not be processed

## 2.57.10 See Also

The PBS Professional User's Guide, the PBS Professional Administrator's Guide, ["Attributes" on page 281](#)

---

## 2.58 qstop

Prevents PBS jobs in the specified queue from being scheduled or routed

### 2.58.1 Synopsis

`qstop <destination> [<destination> ...]`

`qstop --version`

### 2.58.2 Description

If *destination* is an execution queue, the `qstop` command stops a scheduler from scheduling jobs residing in *destination*. If *destination* is a routing queue, the server stops routing jobs from that queue. Sets the value of the queue's *started* attribute to *False*.

#### 2.58.2.1 Required Privilege

You must have PBS Operator or Manager privilege to run this command.

### 2.58.3 Options

`--version`

The `qstop` command returns its PBS version information and exits. This option can only be used alone

### 2.58.4 Operands

The `qstop` command accepts one or more space-separated *destination* operands. The operands take one of three forms:

`<queue name>`

Stops scheduling or routing from the specified queue.

`@<server name>`

Stops scheduling or routing from all queues at the specified server.

`<queue name>@<server name>`

Stops scheduling or routing from the specified queue at the specified server.

To stop scheduling at all queues at the default server, use the `qmgr` command:

```
Qmgr: set queue @default started=false
```

### 2.58.5 Standard Error

The `qstop` command writes a diagnostic message to standard error for each error occurrence.

### 2.58.6 Exit Status

Zero

Upon successful processing of all operands presented to the `qstop` command

Greater than zero

If the `qstop` command fails to process any operand

## 2.58.7 See Also

The PBS Professional Administrator's Guide, ["qmgr" on page 157](#), ["qstart" on page 203](#)



## 2.59 qsub

Submits a job to PBS

### 2.59.1 Synopsis

```
qsub [-a <date and time>] [-A <account string>] [-c <checkpoint spec>] [-C <directive prefix>] [-e <path>] [-f] [-h]
[-I [-G [-- <GUI application/script>]] | [-X]] [-j <join>] [-J <range> [%<max subjobs>]] [-k <discard>] [-l
<resource list>] [-m <mail events>] [-M <user list>] [-N <name>] [-o <path>] [-p <priority>] [-P <project>]
[-q <destination>] [-r <y | n>] [-R <remove options>] [-S <path list>] [-u <user list>] [-v <variable list>] [-V]
[-W <additional attributes>] [-z] [- | <script> | -- <executable> [<arguments to executable>]]
```

```
qsub --version
```

### 2.59.2 Description

You use the `qsub` command to submit a batch job to PBS. Submitting a PBS job specifies a task, requests resources, and sets job attributes.

The `qsub` command can read from a job script, from standard input, or from the command line.

- To use a job script:

```
qsub [<options>] <job script containing directives and executable>
qsub [<options>] <directives> <job script containing other directives and executable>
```

- To submit from the command line:

```
qsub [<options>] <directives> -- <executable> <arguments to executable>
```

- To submit from standard input:

```
qsub <return>
<directives>
<executable>
<CTRL-D>
```

When the user has submitted the job, PBS returns the job identifier for that job. For a job, this is of the form:

```
<sequence number>.<server name>
```

For an array job, this is of the form:

```
<sequence number>[<server name>]
```

During execution, jobs can be interactive or non-interactive. Interactive jobs are not rerunnable, and if they are blocking, you cannot use their exit status.

Jobs are run as the user and group who submitted the job.

#### 2.59.2.1 Background Process

By default, on the first invocation, `qsub` spawns a background process to manage communication with the PBS server. Later invocations of `qsub` attempt to communicate with this background process. Under certain circumstances, calls to `qsub` when it uses the background process can result in communication problems. You can prevent `qsub` from spawning a background process by using the `-f` option, although this can degrade performance.

### 2.59.2.2 Where PBS Puts Job Files

By default, PBS copies the `stdout` and `stderr` files from the job back to the current working directory where the `qsub` command is executed. However, you can specify the output paths using the `-o` and `-e` options. You can also specify which and whether these files should be kept on the execution host via the `-k` option, or deleted, using the `-R` option.

See the `-k`, `-o`, `-e`, and `-R` options, and ["Managing Output and Error Files", on page 42 of the PBS Professional User's Guide](#).

### 2.59.2.3 Submitting Jobs By Using Job Scripts

To submit a PBS job by using a script, you specify a job script on the command line:

```
qsub [<options>] <script name>
```

For example:

```
qsub myscript.sh
```

Job scripts are run as the user and group who submitted the job. Job scripts can be written in Python, Linux shells such as `csh` and `sh`, the Windows command batch language, Perl, etc.

A PBS job script consists of the following:

- Optional shell specification
- Any PBS directives
- The user's tasks: programs, commands, or applications
- Optional comments

Under Windows, comments can contain only ASCII characters. See the PBS Professional User's Guide.

#### 2.59.2.3.i Using Shells and Interpreters

By default, PBS uses your login shell to run your script. You can optionally specify a different shell or interpreter to run your script:

- Via the `-S` option to `qsub`:

```
qsub -S <path to shell> <script name>
```

For example:

```
qsub -S /bin/bash myscript.sh
```

- You can specify a different interpreter in the first line of your script. For example:

```
cat myscript.sh
```

```
#!/bin/bash
```

```
#PBS -N MyHelloJob
```

```
echo "Hello"
```

#### 2.59.2.3.ii Python Job Scripts

You can use the same Python script under Linux or under Windows, if the script is written to be portable. PBS includes a Python package, allowing Python job scripts to run; you do not need to install Python. You can include PBS directives in a Python job script as you would in a Linux shell script. Python job scripts can access Win32 APIs, including the following modules:

```
Win32api
```

```
Win32con
```

Pywintypes

Example 2-25: We have a Python job script that includes PBS directives:

```
cat myjob.py
#!/usr/bin/python
#PBS -l select=1:ncpus=3:mem=1gb
#PBS -N HelloJob
print "Hello"
```

As long as the first line of the script is `#!/usr/bin/python` or similar, you don't need to do anything special to run a Python script:

```
qsub <script name>
```

For example:

```
qsub myscript.py
```

To run a Python job script under Windows, use the path to the `pbs_python` executable on the execution host:

```
qsub -S <pbs_python path on execution host> <script name>
```

For example:

```
qsub -S %PBS_EXEC%\bin\pbs_python.exe <script name>
```

If the script pathname contains spaces, it must be quoted, for example:

```
qsub -S "C:\Program Files\PBS\bin\pbs_python.exe" <script name>
```

### 2.59.2.3.iii Linux Shell Job Scripts

Example 2-26: We have a Linux job script named "weatherscript" for a job named "Weather1" which runs the executable "weathersim" on Linux:

```
#!/bin/sh
#PBS -N Weather1
#PBS -l walltime=1:00:00
/usr/local/weathersim
```

To submit the job, the user types:

```
qsub weatherscript <return>
```

### 2.59.2.3.iv Windows Command Job Scripts

Example 2-27: We have a script named "weather.exe" for a job named "Weather1" which runs under Windows:

```
#PBS -N Weather1
#PBS -l walltime=1:00:00
weathersim.exe
```

To submit the job, the user types:

```
qsub weather.exe <return>
```

In Windows, if you use `notepad` to create a job script, the last line does not automatically get newline-terminated. Be sure to put one explicitly, otherwise, PBS job will get the following error message:

```
More?
```

when the Windows command interpreter tries to execute that last line.

### 2.59.2.4 Submitting Jobs From Standard Input

To submit a PBS job by typing job specifications at the command line, you type:

```
qsub [<options>] [-] <return>
```

then type any directives, then any tasks, followed by:

- Linux: CTRL-D on a line by itself
- Windows: CTRL-Z <return>

to terminate the input.

The `qsub` command behaves the same both with and without the dash operand.

For example, on Linux:

```
qsub <return>
#PBS -N StdInJob
#PBS -l walltime=1:00:00
sleep 100
<CTRL-D>
```

### 2.59.2.5 Submitting Job Directly by Specifying Executable on Command Line

To submit a job directly, you specify the executable on the command line:

```
qsub [<options>] -- <executable> [<arguments to executable>] <return>
```

When you run `qsub` this way, it runs the *executable* directly. It does not start a shell, so no shell initialization scripts are run, and execution paths and other environment variables are not set. There is not an easy way to run your command in a different directory. You should make sure that environment variables are set correctly, and you will usually have to specify the full path to the command.

On Linux, specify the full path to the executable.

Example 2-28: To run `myprog` with the arguments *a* and *b*:

```
qsub -- myprog a b <return>
```

Example 2-29: To run `myprog` with the arguments *a* and *b*, naming the job "JobA":

```
qsub -N JobA -- myprog a b <return>
```

Example 2-30: To run `myprog` on a Linux system with the arguments *a* and *b*, naming the job "JobA":

```
qsub -N JobA -- <path to myprog>/myprog a b <return>
```

### 2.59.2.6 Requesting Resources and Placing Jobs

Requesting resources includes setting limits on resource usage and controlling how the job is placed on vnodes.

Resources are requested by using the `-l` option, either in job-wide requests using `<resource name>=<value>` pairs, or in chunks inside of *selection statements*. See [Chapter 5, "List of Built-in Resources", on page 265](#).

Job-wide `<resource name>=<value>` requests are of the form:

```
-l <resource name>=<value>[,<resource name>=<value> ...]
```

The selection statement is of the form:

```
-l select=[<N>:]<chunk>[+ [<N>:]<chunk> ...]
```

where  $N$  specifies how many of that chunk, and a *chunk* is of the form:

```
<resource name>=<value>[:<resource name>=<value> ...]
```

You choose how your chunks are placed using the *place statement*. The *place statement* can contain the following elements, in any order:

```
-l place=[<arrangement>][[: <sharing> ][: <grouping>]]
```

where

*arrangement*

Whether this chunk is willing to share this vnode or host with other chunks from the same job. One of *free* | *pack* | *scatter* | *vscatter*

*sharing*

Whether this this chunk is willing to share this vnode or host with other jobs. One of *excl* | *shared* | *exclhost*

*grouping*

Whether the chunks from this job should be placed on vnodes that all have the same value for a resource. Can have only one instance of *group=<resource name>*

*free*

Place job on any vnode(s).

*pack*

All chunks are taken from one host.

*scatter*

Only one chunk with any MPI processes is taken from a host. A chunk with no MPI processes may be taken from the same vnode as another chunk.

*vscatter*

Only one chunk is taken from any vnode. Each chunk must fit on a vnode.

*excl*

Only this job uses the vnodes chosen.

*shared*

This job can share the vnodes chosen.

*exclhost*

The entire host is allocated to the job.

*group=<resource name>*

Chunks are grouped according to a resource. All vnodes in the group must have a common value for *resource*, which can be either the built-in resource *host* or a custom vnode-level resource.

*resource name* must be a string or a string array.

The place statement cannot begin with a colon. Colons are delimiters; use them only to separate parts of a place statement, unless they are quoted inside resource values.

Note that vnodes can have *sharing* attributes that override job placement requests. See [section 6.10, “Vnode Attributes”, on page 325](#).

For more on resources, resource requests, usage limits, and job placement, see ["Using PBS Resources" on page 229 in the PBS Professional Administrator's Guide](#) and ["Allocating Resources & Placing Jobs", on page 51 of the PBS Professional User's Guide](#).

### 2.59.2.6.i Caveats for Requesting Resources

Do not mix old-style resource or vnode specifications with the new *select* and *place* statements. Do not use one in a job script and the other on the command line. Mixing the two will result in an error.

You cannot submit a job requesting a custom resource which has been created to be invisible or read-only for unprivileged users, regardless of your privilege. A Manager or Operator can use the `qalter` command to change a job's request for this kind of custom resource.

### 2.59.2.7 Setting Attributes

The job submitter sets job attributes by giving options to the `qsub` command or by using PBS directives. Most `qsub` options set a job attribute, and have a corresponding PBS directive with the same syntax as the option. Attributes set via command-line options take precedence over those set using PBS directives. See the PBS Professional User's Guide, or [section 6.11, "Job Attributes", on page 332](#).

### 2.59.2.8 Running Your Job on First Available Resources

You may want to run a job on whichever resources become available first, even if the job could run on other sets of resources. You may want to start a flexible job as soon as possible on a smaller set of resources rather than waiting longer for a larger set of resources, or you may prefer certain resources but be able to use others (for example, you might prefer a specific processor, but still be able to run on another if that is all that's available).

If you submit a set of jobs where each job has a "runone" dependency on the others, PBS runs only one of the jobs in the "runone set". PBS automatically groups the jobs into a runone set. The jobs in a runone set can run different scripts.

When any of the jobs in the set starts, PBS applies a system hold to the others. The hold on the other jobs is released when the running job is requested:

- Via `qrerun`
- When node fail requeue is triggered

The other jobs in the set are deleted:

- When a job ends, regardless of its exit status
- When the running job is deleted

To identify a job as a member of the set, give it a "runone" dependency on the previously-submitted member of the set. For example, we have three jobs, each of which runs on different resources. To submit these three jobs as a runone set:

```
qsub -lselect=200:ncpus=16 -lwalltime=1:00:00 myscript.sh
10.myserver
qsub -lselect=100:ncpus=16 -lwalltime=2:00:00 -Wdepend=runone:10 myscript.sh
11.myserver
qsub -lselect=50:ncpus=16 -lwalltime=4:00:00 -Wdepend=runone:10 myscript.sh
12.myserver
```

### 2.59.2.9 Changing `qsub` Behavior

The behavior of the `qsub` command may be affected by the server's `default_qsub_arguments` attribute. This attribute can set the default for any job attribute. The `default_qsub_arguments` server attribute is settable by the administrator, and is overridden by command-line arguments and script directives. See [section 6.6, "Server Attributes", on page 285](#).

The behavior of the `qsub` command may also be affected by any site hooks. Site hooks can modify the job's attributes, change its routing, etc.

## 2.59.3 Options to qsub

### -a <date and time>

Point in time after which the job is eligible for execution. Given in pairs of digits. Sets job's `Execution_Time` attribute to *date and time*.

Format: *datetime*, expressed as `[[[CC]YY]MM]DD]hhmm[.SS]`

where *CC* is the century, *YY* is the year, *MM* is the month, *DD* is the day of the month, *hh* is the hour, *mm* is the minute, and *SS* is the seconds.

Each portion of the date defaults to the current date, as long as the next-smaller portion is in the future. For example, if today is the 3rd of the month and the specified day *DD* is the 5th, the month *MM* is set to the current month.

If a specified portion has already passed, the next-larger portion is set to one after the current date. For example, if the day *DD* is not specified, but the hour *hh* is specified to be 10:00 a.m. and the current time is 11:00 a.m., the day *DD* is set to tomorrow.

### -A <account string>

Accounting string associated with the job. Used for labeling accounting data. Sets job's `Account_Name` attribute to *account string*.

Format: *String*

### -c <checkpoint spec>

Determines when the job will be checkpointed. Sets job's `Checkpoint` attribute to *checkpoint spec*. An `$action` script is required to checkpoint the job.

See ["Using Checkpointing", on page 115 of the PBS Professional User's Guide](#).

The argument *checkpoint spec* can take one of the following values:

**c**

Checkpoint at intervals, measured in CPU time, set on job's execution queue. If there is no interval set at the queue, the job is not checkpointed

**c=<minutes of CPU time>**

Checkpoint at intervals of specified number of minutes of job CPU time. This value must be greater than zero. If the interval specified is less than that set on the job's execution queue, the queue's interval is used.

Format: *Integer*

**w**

Checkpoint at intervals, measured in **walltime**, set on job's execution queue. If there is no interval set at the queue, the job is not checkpointed.

**w=<minutes of walltime>**

Checkpoint at intervals of the specified number of minutes of job **walltime**. This value must be greater than zero. If the interval specified is less than that set on the job's execution queue, the queue's interval is used.

Format: *Integer*

**n**

No checkpointing.

**s**

Checkpoint only when the server is shut down.

**u**

Unset. Defaults to behavior when *interval* argument is set to **s**.

Default: *u*

Format: *String*

**-C <directive prefix>**

Defines the prefix identifying a PBS directive. Default prefix is *"#PBS"*.

If the *directive prefix* argument is a null string, `qsub` does not scan the script file for directives. Overrides the `PBS_DPREFIX` environment variable and the default. The string `"PBS_DPREFIX"` cannot be used as a PBS directive. Length limit: 4096 characters.

**-e <path>**

Path to be used for the job's standard error stream. Sets job's `Error_Path` attribute to *path*. The *path* argument is of the form:

*[<hostname>:]<path>*

The *path* is interpreted as follows:

*path*

If *path* is relative, it is taken to be relative to the current working directory of the `qsub` command, where it is executing on the current host.

If *path* is absolute, it is taken to be an absolute path on the current host where the `qsub` command is executing.

*hostname:path*

If *path* is relative, it is taken to be relative to the user's home directory on the host named *hostname*.

If *path* is absolute, it is an absolute path on the host named *hostname*.

If *path* does not include a filename, the default filename has the form *<job ID>.ER*

If the `-e` option is not specified, PBS copies the standard error to the current working directory where the `qsub` command was executed, and writes standard error to the default filename, which has this form:

*<job name>.e<sequence number>*

If you use a UNC path for output or error files, the *hostname* is optional. If you use a non-UNC path, the *hostname* is required.

This option is overridden by the `-k` option.

**-f**

Prevents `qsub` from spawning a background process. By default, `qsub` spawns a background process to manage communication with the PBS server. When this option is specified, the `qsub` process connects directly to the server and no background process is created.

NOTE: Use of this option degrades performance of `qsub` when calls to `qsub` are made in rapid succession.

**-G [<path to GUI application or script>]**

Starts a GUI session. When no application or script is provided, starts a GUI-enabled interactive shell. When an application or script is provided, starts the GUI application or script. Use full path to application or script unless the path is part of the user's `PATH` environment variable on the execution host. When submission and execution hosts are different, this uses a remote viewer.

Session is terminated when remote viewer, GUI application, or interactive shell is terminated, or when job is deleted.

Can be used only with interactive jobs (the `-I` option).

Available only under Windows.

**-h**

Applies a *User* hold to the job. Sets the job's `Hold_Types` attribute to *"u"*.



-l

Job is to be run interactively. Sets job's `interactive` attribute to *True*. The job is queued and scheduled as any PBS batch job, but when executed, the standard input, output, and error streams of the job are connected to the terminal session in which `qsub` is running. If a job script is given, only its directives are processed. When the job begins execution, all input to the job is taken from the terminal session. See the PBS Professional User's Guide for additional information on interactive jobs.

Interactive jobs are not rerunnable.

Job arrays cannot be interactive.

When used with `-Wblock=true`, no exit status is returned.

-j <join>

Specifies whether and how to join the job's standard error and standard output streams. Sets job's `Join_Path` attribute to *join*.

Default: *n*; not merged

The *join* argument can take the following values:

**Table 2-35: Sub-options to -j Option**

| Suboption | Meaning   |
|-----------|---|
| <i>oe</i> | Standard error and standard output are merged into standard output. |
| <i>eo</i> | Standard error and standard output are merged into standard error.  |
| <i>n</i>  | Standard error and standard output are not merged.                  |

-J <range> [%<max subjobs>]

Makes this job an array job. Sets job's `array` attribute to *True*.

Use the *range* argument to specify the indices of the subjobs of the array. *range* is specified in the form *X-Y[:Z]* where *X* is the first index, *Y* is the upper bound on the indices, and *Z* is the stepping factor. For example, *2-7:2* will produce indices of *2*, *4*, and *6*. If *Z* is not specified, it is taken to be *1*. Indices must be greater than or equal to zero.

Use the optional *%max subjobs* argument to set a limit on the number of subjobs that can be running at one time. This sets the value of the `max_run_subjobs` job attribute to the specified maximum.

Job arrays are always rerunnable.

-k <discard>

Specifies whether and which of the standard output and standard error streams is left behind on the execution host, or written to their final destination. Sets the job's `Keep_Files` attribute to *discard*.

k {e | o | eo | oe | n}

For the *e*, *o*, *eo*, *oe*, or *n* suboptions, overrides `-o <output path>` and `-e <error path>` options.

kd {e | o | eo | oe}

When used with the -d suboption, specifies that output and/or error files are written directly to the final destination. Requires e and/or o sub-options.

Default: *n*; neither is retained, and files are not written directly to final destinations.

In the case where output and/or error is retained on the execution host in a job-specific staging and execution directory created by PBS, these files are deleted when PBS deletes the directory.

The *discard* argument can take the following values:

**Table 2-36: Sub-options to discard Option**

| Suboption                  | Meaning  |
|----------------------------|--|
| <i>e</i>                   | The standard error stream is retained on the execution host, in the job's staging and execution directory. The filename is <i>&lt;job name&gt;.e&lt;sequence number&gt;</i>  |
| <i>o</i>                   | The standard output stream is retained on the execution host, in the job's staging and execution directory. The filename is <i>&lt;job name&gt;.o&lt;sequence number&gt;</i> |
| <i>eo, oe</i>              | Both standard output and standard error streams are retained on the execution host, in the job's staging and execution directory.  |
| <i>d&lt;e and/or o&gt;</i> | Output and/or error are written directly to their final destination. Overrides action of leaving files on execution host. Requires e and/or o sub-options.                   |
| <i>n</i>                   | Neither stream is retained.  |

-l <resource list>

Allows the user to request resources and specify job placement. Sets job's *Resource\_list* attribute to *resource list*. Requesting a resource places a limit on its usage.

For how to request resources and place jobs, see [section 2.59.2.6, “Requesting Resources and Placing Jobs”](#), on [page 224](#).

**-m <mail events>**

Specifies the set of conditions under which mail about the job is sent. Sets job's **Mail\_Points** attribute to *mail events*. The *mail events* argument can be one of the following:

- The single character "*n*"
- Any combination of "*a*", "*b*", and "*e*", with optional "*j*"

The following table lists the sub-options to the -m option:

**Table 2-37: Sub-options to m Option**

| Suboption | Meaning  |
|-----------|--|
| <i>n</i>  | No mail is sent.   |
| <i>a</i>  | Mail is sent when the job is aborted by PBS.   |
| <i>b</i>  | Mail is sent when the job begins execution.  |
| <i>e</i>  | Mail is sent when the job terminates.  |
| <i>j</i>  | Mail is sent for subjobs. Must be combined with one or more of <i>a</i> , <i>b</i> , or <i>e</i> options |

Format: *String*

Syntax: *n* | [*j*](one or more of *a*, *b*, *e*)

Example: -m ja

Default value: "*a*"

**-M <user list>**

List of users to whom mail about the job is sent. Sets job's **Mail\_Users** attribute to *user list*.

The *user list* argument has the form:

<username>[&lt;hostname>][,&lt;username>[&lt;hostname>],...]

Default: Job owner

**-N <name>**

Sets job's **Job\_Name** attribute and name to *name*.

Format: *Job Name*; see ["Job Name, Job Array Name" on page 359](#)

Default: if a script is used to submit the job, the job's name is the name of the script. If no script is used, the job's name is "**STDIN**".

**-o <path>**

Path to be used for the job's standard output stream. Sets job's **Output\_Path** attribute to *path*. The *path* argument has the form:

[&lt;hostname>:]&lt;path>

The *path* is interpreted as follows:

*path*

If *path* is relative, it is taken to be relative to the current working directory of the **qsub** command, where it is executing on the current host.

If *path* is absolute, it is taken to be an absolute path on the current host where the **qsub** command is executing.

*hostname:path*

If *path* is relative, it is taken to be relative to the user's home directory on the host named *hostname*.

If *path* is absolute, it is an absolute path on the host named *hostname*.

If *path* does not include a filename, the default filename has the form *<job ID>.OU*

If the `-o` option is not specified, PBS copies the standard output to the current working directory where the `qsub` command was executed, and writes standard output to the default filename, which has this form:

*<job name>.o<sequence number>*

If you use a UNC path, the hostname is optional. If you use a non-UNC path, the hostname is required.

This option is overridden by the `-k` option.

#### **-p <priority>**

Priority of the job. Sets job's **Priority** attribute to *priority*.

Format: Host-dependent integer

Range: [-1024, +1023] inclusive

Default: *Zero*

#### **-P <project>**

Specifies a project for the job. Sets job's **project** attribute to *project*.

Format: *Project Name*; see ["Project Name" on page 361](#)

Default value: *"\_pbs\_project\_default"*.

#### **-q <destination>**

Where the job is sent upon submission.

Specifies a queue, a server, or a queue at a server. The destination argument can have one of these formats:

*<queue name>*

Job is submitted to the specified queue at the default server.

*@<server name>*

Job is submitted to the default queue at the specified server.

*<queue name>@<server name>*

Job is submitted to the specified queue at the specified server.

Default: Default queue at default server

#### **-r <y|n>**

Declares whether the job is rerunnable. Sets job's **Rerunnable** attribute to the argument value. Does not affect how the job is handled in the case where the job was unable to begin execution.

Format: Single character, *"y"* or *"n"*

**Table 2-38: Sub-options to r Option**

| Suboption | Meaning                |
|-----------|------------------------|
| <i>y</i>  | Job is rerunnable.     |
| <i>n</i>  | Job is not rerunnable. |

Default: *"y"*

Interactive jobs are not rerunnable. Job arrays are always rerunnable. See ["qrerun" on page 186](#).

**-R <remove options>**

Specifies whether standard output and/or standard error files are automatically removed (deleted) upon job completion.

Sets the job's `Remove_Files` attribute to *remove options*. Overrides default path names for these streams. Overrides `-o` and `-e` options.

This attribute cannot be altered once the job has begun execution.

Default: *Unset*; neither is removed

The *remove options* argument can take the following values:

**Table 2-39: discard Argument Values**

| Option        | Meaning   |
|---------------|---|
| <i>e</i>      | The standard error stream is removed (deleted) upon job completion                        |
| <i>o</i>      | The standard output stream is removed (deleted) upon job completion                       |
| <i>eo, oe</i> | Both standard output and standard error streams are removed (deleted) upon job completion |
| <i>unset</i>  | Neither stream is removed.  |

**-S <path list>**

Specifies the interpreter or shell path for the job script. Sets job's `Shell_Path_List` attribute to *path list*.

The *path list* argument is the full path to the interpreter or shell including the executable name.

Only one path may be specified without a hostname. Only one path may be specified per named host. The path selected is the one whose hostname is that of the server on which the job resides.

Format: `<path>[@<hostname>][,<path>@<hostname> ...]`

Default: User's login shell on execution host

Example of using `bash` via a directive:

```
#PBS -S /bin/bash@mars,/usr/bin/bash@jupiter
```

Example of running a Python script from the command line on Linux:

```
qsub -S $PBS_EXEC/bin/pbs_python <script name>
```

Example of running a Python script from the command line on Windows:

```
qsub -S %PBS_EXEC%\bin\pbs_python.exe <script name>
```

**-u <user list>**

List of usernames. Job is run under a username from this list. Sets job's `User_List` attribute to *user list*.

Only one username may be specified without a hostname. Only one username may be specified per named host. The server on which the job resides will select first the username whose hostname is the same as the server name. Failing that, the next selection is the username with no specified hostname. The usernames on the server and execution hosts must be the same. The job owner must have authorization to run as the specified user.

Format of *user list*: `<username>[@<hostname>][,<username>@<hostname> ...]`

Default: Job owner (username on submission host)

**-v <variable list>**

Specifies environment variables and shell functions to be exported to the job. This is the list of environment variables that are added to those already automatically exported. These variables exist in the user's environment from which `qsub` is run. The job's `Variable_List` attribute is appended with the variables in *variable list* and their values. See [section 2.59.7, “Environment Variables”, on page 238](#).

Format: comma-separated list of strings in the form:

`<variable>`

or

`<variable>=<value>`

If a `<variable>=<value>` pair contains any commas, the value must be enclosed in single or double quotes, and the `<variable>=<value>` pair must be enclosed in the kind of quotes not used to enclose the value. For example:

```
qsub -v "var1='A,B,C,D'" job.sh
```

```
qsub -v "a=10,var2='A,B',c=20,d='Hello world'" job.sh
```

Default: No environment variables are added to job's variable list.

**-V**

All environment variables and shell functions in the user's environment where `qsub` is run are exported to the job. The job's `Variable_List` attribute is appended with all of these environment variables and their values.

**-W <additional attributes>**

The `-W` option allows specification of some job attributes. Some job attributes must be specified using this option. Those attributes are listed below. Format:

`-W <attribute name>=<value>[,<attribute name>=<value>...]`

If white space occurs within the *additional attributes* argument, or the equal sign "=" occurs within a *value* string, it must be enclosed with single quotes or double quotes.

The following attributes can be set using the `-W` option only:

**block=true**

The `qsub` command waits for the job to terminate, then returns the job's exit value. Sets job's `block` attribute to *True*. When used with X11 forwarding or interactive jobs, no exit value is returned. See [section 2.59.8, “Exit Status”, on page 239](#).

**create\_resv\_from\_job=<value>**

When this job starts, immediately creates and confirms a *job-specific start reservation* on the same resources as the job (including resources inherited by the job), and places the job in the job-specific reservation queue. Sets the job's `create_resv_from_job` attribute to *True*. Sets the job-specific reservation's `reserve_job` attribute to the ID of the job from which the reservation was created. The new reservation's duration and start time are the same as the job's walltime and start time. If the job is peer scheduled, the job-specific reservation is created in the pulling complex.

Format: Boolean

Example:

```
qsub -Wcreate_resv_from_job=1 myscript.sh
```

Cannot be used with job arrays or jobs being submitted into a reservation.

**depend=<dependency list>**

Defines dependencies between this and other jobs. Sets the job's **depend** attribute to *dependency list*. The *dependency list* has the form:

`<type>:<arg list>[,<type>:<arg list> ...]`

where except for the *on* type, the *arg list* is one or more PBS job IDs, and has the form:

`<job ID>[:<job ID> ...]`

The type can be:

*after*: `<arg list>`

This job may be scheduled for execution at any point after all jobs in *arg list* have started execution.

*afterok*: `<arg list>`

This job may be scheduled for execution only after all jobs in *arg list* have terminated with no errors.

See [section 2.59.8.1, “Warning About Exit Status with csh”, on page 240](#).

*afternotok*: `<arg list>`

This job may be scheduled for execution only after all jobs in *arg list* have terminated with errors. See

[section 2.59.8.1, “Warning About Exit Status with csh”, on page 240](#).

*afterany*: `<arg list>`

This job may be scheduled for execution after all jobs in *arg list* have finished execution, with any exit status (with or without errors.) This job will not run if a job in the *arg list* was deleted without ever having been run.

*before*: `<arg list>`

Jobs in *arg list* may begin execution once this job has begun execution.

It is uncommon for users to specify a *before* condition. Rather, PBS adds *before* dependencies automatically to the targets of *after* dependencies.

*beforeok*: `<arg list>`

Jobs in *arg list* may begin execution once this job terminates without errors. See [section 2.59.8.1, “Warning About Exit Status with csh”, on page 240](#).

*beforenotok*: `<arg list>`

If this job terminates execution with errors, jobs in *arg list* may begin. See [section 2.59.8.1, “Warning About Exit Status with csh”, on page 240](#).

*beforeany*: `<arg list>`

Jobs in *arg list* may begin execution once this job terminates execution, with or without errors.

*on*: `<count>`

This job may be scheduled for execution after *count* dependencies on other jobs have been satisfied.

This type is used in conjunction with one of the *before* types listed. *count* is an integer greater than 0.

*runone*: `<job ID>`

Puts the current job and the job with *job ID* in a set of jobs out of which PBS will eventually run just one. To add a job to a set, specify the job ID of another job already in the set.

Job IDs in the *arg list* of *before* types must have been submitted with a type of *on*.

To use the *before* types, the user must have the authority to alter the jobs in *arg list*. Otherwise, the dependency is rejected and the new job aborted.

Error processing of the existence, state, or condition of the job on which the newly submitted job is performed after the job is queued. If an error is detected, the new job is deleted by the server. Mail is sent to the job submitter stating the error.

Dependency example:

```
qsub -W depend=afterok:123.host1.domain.com /tmp/script
```

In this example, we save the output (the job ID) from the first `qsub` into the shell variable "jobid" so that we can supply it to the *depend* option on the second job:

```
jobid=`qsub first_step.sh`
qsub -W depend=afterok:$jobid second_step.sh
```

**group\_list=<group list>**

List of group names. Job is run under a group name from this list. Sets job's *group\_list* attribute to *group list*.

Only one group name may be specified without a hostname. Only one group name may be specified per named host. The server on which the job resides will select first the group name whose hostname is the same as the server name. Failing that, the next selection is the group name with no specified hostname. The group names on the server and execution hosts must be the same. The job submitter's primary group is automatically added to the list.

Under Windows, the primary group is the first group found for the user by PBS when it queries the accounts database.

Format of *group list*: *<group name>[@<hostname>][,<group name>@<hostname> ...]*

Default: Login group name of job owner

**release\_nodes\_on\_stageout=<value>**

When set to *True*, all of the job's vnodes not on the primary execution host are released when stageout begins.

When cgroups is enabled and this is used with some but not all vnodes from one MoM, resources on those vnodes that are part of a cgroup are not released until the entire cgroup is released.

The job's *stageout* attribute must be set for the *release\_nodes\_on\_stageout* attribute to take effect.

Format: *Boolean*

Default: *False*

**run\_count=<value>**

Sets the number of times the server thinks it has run the job. Sets the value of the job's *run\_count* attribute to *value*.

Format: Integer greater than or equal to zero

**sandbox=<sandbox spec>**

Determines which directory PBS uses for the job's staging and execution. Sets job's *sandbox* attribute to the value of *sandbox spec*.

Allowed values for *sandbox spec*:

**PRIVATE**

PBS creates a job-specific directory for staging and execution.

**HOME** or **unset**

PBS uses the user's home directory for staging and execution.

Format: *String*



**stagein=<path list>**

**stageout=<path list>**

Specifies files or directories to be staged in before execution or staged out after execution is complete. Sets the job's **stagein** and **stageout** attributes to the specified *path lists*. On completion of the job, all staged-in and staged-out files and directories are removed from the execution host(s). The *path list* has the form:

*<file spec>[, <file spec>]*

where *<file spec>* is

*<execution path>@<hostname>:<storage path>*

regardless of the direction of the copy. The name *execution path* is the name of the file or directory on the primary execution host. It can be relative to the staging and execution directory on the execution host, or it can be an absolute path.

The "@" character separates *execution path* from *storage path*.

The *storage path* is the path on *hostname*. The *storage path* can be absolute, or it can be relative to the user's home directory on *hostname*.

If *path list* has more than one *file spec*, i.e. it contains commas, it must be enclosed in double quotes.

If you use a UNC path, the *hostname* is optional. If you use a non-UNC path, the *hostname* is required.

**umask=<mask value>**

The umask with which the job is started. Sets job's **umask** attribute to *mask value*. Controls umask of job's standard output and standard error.

The following example allows group and world read of the job's output and error:

```
-W umask=33
```

Format: octal; one to four digits; typically two

Default: *system default*

**-X**

Allows user to receive X output from interactive job.

**DISPLAY** variable in submission environment must be set to desired display.

Can be used only with interactive jobs: must be used with one of the following:

**-I**

**-W interactive=true (deprecated)**

Cannot be used with **-v DISPLAY**.

When used with **-Wblock=true**, no exit status is returned.

Can be used with **-V** option.

Not available under Windows.

**-Z**

Job identifier is not written to standard output.

**--version**

The **qsub** command returns its PBS version information and exits. This option can only be used alone.

## 2.59.4 Operands

The **qsub** command accepts as operands one of the following:

(no operands)

Same as with a dash. Any PBS directives and user tasks are read from the command line.

**<script>**

Path to script. Can be absolute or relative to current directory where `qsub` is run. The script must be the last argument to `qsub`.

-

When you use a dash, any PBS directives and user tasks are read from the command line.

**-- <executable> [<arguments to executable>]**

A single executable (preceded by two dashes) and its arguments

The executable, and any arguments to the executable, are given on the `qsub` command line. The executable is preceded by two dashes, "--".

All `qsub` options must come before the "--".

If a script or executable is specified, it must be the last argument to `qsub`. The arguments to an executable must follow the name of the executable.

When you run `qsub` this way, it runs the executable directly. It does not start a shell, so no shell initialization scripts are run, and execution paths and other environment variables are not set. You should make sure that environment variables are set correctly.

## 2.59.5 Standard Output

Job ID for submitted job

If the job is successfully created

(No output)

If the `-z` option is set

## 2.59.6 Standard Error

The `qsub` command writes a diagnostic message to standard error for each error occurrence.

## 2.59.7 Environment Variables

The `qsub` command uses the following environment variables:

**PBS\_DEFAULT**

Name of default server.

**PBS\_DPREFIX**

Prefix string which identifies PBS directives.

Environment variables beginning with "*PBS\_O\_*" are created by `qsub`. PBS automatically exports the following environment variables to the job, and includes them in the job's `Variable_List` attribute:

**PBS\_ENVIRONMENT**

Set to *PBS\_BATCH* for a batch job. Set to *PBS\_INTERACTIVE* for an interactive job.

**PBS\_JOBDIR**

Pathname of job's staging and execution directory on the primary execution host.

**PBS\_JOBID**

Job identifier given by PBS when the job is submitted.

**PBS\_JOBNAME**

Job name specified by submitter.

**PBS\_NODEFILE**

Name of file containing the list of vnodes assigned to the job when the job runs.

**PBS\_O\_HOME**

User's home directory. Value of **HOME** taken from user's submission environment.

**PBS\_O\_HOST**

Name of submit host. Value taken from user's submission environment.

**PBS\_O\_LANG**

Value of **LANG** taken from user's submission environment.

**PBS\_O\_LOGNAME**

User's login name. Value of **LOGNAME** taken from user's submission environment.

**PBS\_O\_MAIL**

Value of **MAIL** taken from user's submission environment.

**PBS\_O\_PATH**

User's **PATH**. Value of **PATH** taken from user's submission environment.

**PBS\_O\_QUEUE**

Name of the queue to which the job was submitted. Value is taken from job submission, otherwise default queue.

**PBS\_O\_SHELL**

Value of **SHELL** taken from user's submission environment.

**PBS\_O\_SYSTEM**

Operating system, from `uname -s`, on submit host. Value taken from user's submission environment.

**PBS\_O\_TZ**

Timezone. Value taken from user's submission environment.

**PBS\_O\_WORKDIR**

Absolute path to directory where `qsub` is run. Value taken from user's submission environment.

**PBS\_QUEUE**

Name of the queue from which the job is executed.

**PBS\_TMPDIR**

Pathname of scratch directory for PBS components. Set when PBS assigns it.

## 2.59.8 Exit Status

For non-blocking jobs:

**Zero**

Upon successful processing of input

**Greater than zero**

Upon failure of `qsub`

For blocking jobs:

**Exit value of job**

When job runs successfully

**3**

If the job is deleted without being run

### 2.59.8.1 Warning About Exit Status with `csch`

If a job is run in `csch` and a `.logout` file exists in the user's home directory on the host where the job executes, the exit status of the job is that of the `.logout` script, not the job script. This may impact any inter-job dependencies.

### 2.59.9 See Also

["Submitting a PBS Job", on page 11 of the PBS Professional User's Guide](#), ["Job Attributes" on page 332](#), ["Resources Built Into PBS" on page 271](#), and ["Requesting Resources", on page 53 of the PBS Professional User's Guide](#).

## 2.60 qterm

Terminates one or both PBS servers, and optionally terminates scheduler(s) and/or MoMs

### 2.60.1 Synopsis

```
qterm [ -f | -F | -i ] [ -m ] [ -s ] [ -t <type> ] [ <server name> [ <server name> ... ] ]
qterm --version
```

### 2.60.2 Description

The `qterm` command terminates a PBS batch server.

Once the server is terminating, no new jobs are accepted by the server, and no jobs are allowed to begin execution. The impact on running jobs depends on the way the server is shut down.

The `qterm` command does not exit until the server has completed its shutdown procedure.

If the complex is configured for failover, and the primary server is shut down, the normal behavior for the secondary server is to become active. The `qterm` command provides options to manage the behavior of the secondary server; it can be shut down, forced to remain idle, or shut down in place of the primary server.

#### 2.60.2.1 Required Privilege

In order to run the `qterm` command, you must have PBS Operator or Manager privilege.

### 2.60.3 Options to qterm

(no options)

The `qterm` command defaults to `qterm -t quick`.

**-f**

If the complex is configured for failover, shuts down both the primary and secondary servers.

Without the `-f` option, `qterm` shuts down the primary server and makes the secondary server active.

The `-f` option cannot be used with the `-i` or `-F` options.

**-F**

If the complex is configured for failover, shuts down only the secondary server, leaving the primary server active.

The `-F` option cannot be used with the `-f` or `-i` options.

**-i**

If the complex is configured for failover, leaves the secondary server idle when the primary server is shut down.

The `-i` option cannot be used with the `-f` or `-F` options.

**-m**

Shuts down the primary server and all MoMs (`pbs_mom`). This option does not cause jobs or subjobs to be killed. Jobs are left running subject to other options to the `qterm` command.

**-s**

Shuts down the primary server and the scheduler (`pbs_sched`).

**-t <type>****immediate**

Shuts down the primary server. Immediately stops all running jobs. Any running jobs that can be checkpointed are checkpointed, terminated, and queued. Jobs that cannot be checkpointed are terminated and queued if they are rerunnable, otherwise they are killed.

If any job cannot be terminated, for example the server cannot contact the MoM of a running job, the server continues to execute and the job is listed as running. The server can be terminated by a second `qterm -t immediate` command.

While terminating, the server is in the *Terminating* state.

**delay**

Shuts down the primary server. The server waits to terminate until all non-checkpointable, non-rerunnable jobs are finished executing. Any running jobs that can be checkpointed are checkpointed, terminated, and queued. Jobs that cannot be checkpointed are terminated and queued if they are rerunnable, otherwise they are allowed to continue to run.

While terminating, the server is in the *Terminating-Delayed* state.

**quick**

Shuts down the primary server. Running jobs and subjobs are left running.

This is the default behavior when no options are given to the `qterm` command.

While terminating, the server is in the *Terminating* state.

**--version**

The `qterm` command returns its PBS version information and exits. This option can only be used alone.

## 2.60.4 Operands

You optionally specify the list of servers to shut down using [`<server name>`[ `<server name>` ...]].

If you do not specify any servers, the `qterm` command shuts down the default server.

### 2.60.4.1 Standard Error

The `qterm` command writes a diagnostic message to standard error for each error occurrence.

### 2.60.4.2 Exit Status

**Zero**

Upon successful processing of all operands presented to the `qterm` command

**Greater than zero**

If the `qterm` command fails to process any operand

### 2.60.4.3 See Also

The PBS Professional Administrator's Guide, ["pbs\\_server" on page 110](#), ["pbs\\_sched" on page 108](#), ["pbs\\_mom" on page 74](#)

## 2.61 tracejob

Extracts and prints log messages for a PBS job

### 2.61.1 Synopsis

```
tracejob [-a] [-c <count>] [-f <filter>] [-l] [-m] [-n <days>] [-p <path>] [-s] [-v] [-w <cols>] [-z] <job ID>  
tracejob --version
```

### 2.61.2 Description

The `tracejob` command extracts log messages for a given *job ID* and prints them in chronological order.

The `tracejob` command extracts information from server, default scheduler, accounting, and MoM logs. Server logs contain information such as when a job was queued or modified. Scheduler logs contain clues as to why a job is not running. Accounting logs contain accounting records for when a job was queued, started, ended, or deleted. MoM logs contain information about what happened to a job while it was running.

To get MoM log messages for a job, `tracejob` must be run on the machine on which the job ran. If the job ran on multiple hosts, you must run `tracejob` on each of those hosts.

Some log messages appear many times. In order to make the output of `tracejob` more readable, messages that appear over a certain number of times (see option `-c` below) are restricted to only the most recent message.

### 2.61.3 Using tracejob on Job Arrays

If `tracejob` is run on a job array, the information returned is about the job array itself, and not its subjobs. Job arrays do not have associated MoM log messages. If `tracejob` is run on a subjob, the same types of log messages are available as for a job. Certain log messages that occur for a regular job will not occur for a subjob.

### 2.61.4 Required Privilege

All users have access to server, scheduler, and MoM information. Only Administrator or root can access accounting information.

### 2.61.5 Options to tracejob

`-a`

Do not report accounting information.

`-c <count>`

Set excessive message limit to *count*. If a message is logged at least *count* times, only the most recent message is printed.

The default for *count* is 15.

**-f <filter>**

Do not include log events of type *filter*. The **-f** option can be used more than once on the command line. The following table shows each filter with its hex value and category:

**Table 2-40: tracejob Filters**

| Filter           | Hex Value     | Message Category               |
|------------------|---------------|--------------------------------|
| <i>error</i>     | <i>0x0001</i> | Internal errors                |
| <i>system</i>    | <i>0x0002</i> | System errors                  |
| <i>admin</i>     | <i>0x0004</i> | Administrative events          |
| <i>job</i>       | <i>0x0008</i> | Job-related events             |
| <i>job_usage</i> | <i>0x0010</i> | Job accounting info            |
| <i>security</i>  | <i>0x0020</i> | Security violations            |
| <i>sched</i>     | <i>0x0040</i> | Scheduler events               |
| <i>debug</i>     | <i>0x0080</i> | Common debug messages          |
| <i>debug2</i>    | <i>0x0100</i> | Uncommon debug messages        |
| <i>resv</i>      | <i>0x0200</i> | Reservation debug messages     |
| <i>debug3</i>    | <i>0x0400</i> | Less common than <i>debug2</i> |
| <i>debug4</i>    | <i>0x0800</i> | Less common than <i>debug3</i> |

**-l**

Do not report scheduler information.

**-m**

Do not report MoM information.

**-n <days>**

Report information from up to *days* days in the past.

Default number of days: *1* = today

**-p <path>**

Use *path* as path to PBS\_HOME on machine being queried.

**-s**

Do not report server information.

**-w <cols>**

Width of current terminal. If *cols* is not specified, `tracejob` queries OS to get terminal width. If OS doesn't return anything, defaults to *80*.

**-v**

Verbose. Report more of `tracejob`'s errors than default.

**-Z**

Suppresses printing of duplicate messages.

**--version**

The `tracejob` command returns its PBS version information and exits. This option can only be used alone.



---

## 2.61.6 Operands

The `tracejob` command accepts one *job ID* operand.

For a job, this has the form:

```
<sequence number>[.<server name>][@<server name>]
```

For a job array, the form is:

```
<sequence number>[[.<server name>][@<server name>]
```

For a subjob, the form is:

```
<sequence number>[<index>][.<server name>][@<server name>]
```

Note that some shells require that you enclose a job array identifier in double quotes.

## 2.61.7 Exit Status

Zero

Upon successful processing of all options

Greater than zero

If `tracejob` is unable to process any options

## 2.61.8 See Also

The PBS Professional Administrator's Guide

## 2.62 win\_postinstall.py

For Windows. Configures PBS MoM or client

### 2.62.1 Synopsis

```
<PBS_EXEC>\etc\python win_postinstall.py -u <PBS service account> -p <PBS service account password> -t  
<installation type> -s <server name> [-c <path to scp command>]
```

### 2.62.2 Description

The `win_postinstall.py` command configures the PBS MoM and commands. It performs post-installation steps such as validating the PBS service account username and password, installing the Visual C++ redistributable binary, and creating the `pbs.conf` file in the PBS destination folder.

For an "execution" type of installation, it creates `PBS_HOME`, and registers and starts the `PBS_MOM` service.

When you use this command during an "execution" type installation of PBS, the command automatically un-registers any old PBS MoM.

Available on Windows only.

#### 2.62.2.1 Required Privilege

You must have Administrator privilege to run this command.

### 2.62.3 Options to win\_postinstall.py

`-c, --scp-path <path to scp command>`

Specifies path to `scp` command.

`-p, --passwd <PBS service account password>`

Specifies password for PBS service account.

`-s, --server <server name>`

Specifies the hostname on which the PBS server will run; required when the installation type is one of "execution" or "client".

`-t, --type <installation type>`

Specifies type of installation. Type can be one of "execution" or "client".

`-u, --user <PBS service account>`

Specifies PBS service account. When you specify the PBS service account, whether or not you are on a domain machine, include only the username, not the domain. For example, if the full username on a domain machine is `<domain>\<username>`, pass only `<username>` as an argument.

# MoM Parameters

This chapter describes the configuration files used by MoM and lists the MoM configuration parameters that are found in the Version 1 MoM configuration file, *PBS\_HOME/mom\_priv/config*. See ["About MoMs" on page 39 in the PBS Professional Administrator's Guide](#).

## 3.1 Syntax of MoM Configuration File

The Version 1 MoM configuration file contains parameter settings for the MoM on the local host.

Version 1 configuration files list local resources and initialization values for MoM. Local resources are either static, listed by name and value, or externally-provided, listed by name and command path. Local static resources are for use only by the scheduler for MoM's partition. They do not appear in a `pbsnodes -a` query. See the `-c` option to the `pbs_mom` command. Do not change the syntax of the Version 1 configuration file.

Each configuration item is listed on a single line, with its parts separated by white space. Comments begin with a hash-mark ("`#`").

### 3.1.1 Windows Notes

If the argument to a MoM option is a pathname containing a space, enclose it in double quotes as in the following:

```
hostn !"\Program Files\PBS\exec\bin\hostn" host
```

When you edit any PBS configuration file, make sure that you put a newline at the end of the file. The Notepad application does not automatically add a newline at the end of a file; you must explicitly add the newline.

## 3.2 Contents of MoM Configuration File

### 3.2.1 Replacing Actions

*\$action* <default action> <timeout> <new action>

Replaces the *default action* for an event with the site-specified *new action*. *timeout* is the time allowed for *new action* to run. *new action* is the site-supplied script that replaces *default action*. This is the complete list of values for *default action*:

**Table 3-1: How \$action is Used**

| default action                                   | Result   |
|--|--|
| <i>checkpoint</i>                                | Run <i>new action</i> in place of the periodic job checkpoint, after which the job continues to run.   |
| <i>checkpoint_abort</i>                          | Run <i>new action</i> to checkpoint the job, after which the job must be terminated by the script.   |
| <i>multinodebusy</i> <timeout><br><i>requeue</i> | Used with cycle harvesting and multi-vnode jobs. Changes default behavior when a vnode becomes busy. Instead of allowing the job to run, the job is requeued. Timeout is ignored. The only <i>new action</i> is <i>requeue</i> . |
| <i>restart</i>                                   | Runs <i>new action</i> in place of restart.  |
| <i>terminate</i>                                 | Runs <i>new action</i> in place of SIGTERM or SIGKILL when MoM terminates a job.   |

### 3.2.2 MoM Parameters

*\$checkpoint\_path* <path>

MoM passes this parameter to the checkpoint and restart scripts. This path can be absolute or relative to `PBS_HOME/mom_priv`. Overrides default. Overridden by path specified in the `pbs_mom -C` option and by `PBS_CHECKPOINT_PATH` environment variable. See ["Specifying Checkpoint Path" on page 413 in the PBS Professional Administrator's Guide](#).

*\$clienthost* <hostname>

*hostname* is added to the list of hosts which are allowed to connect to MoM as long as they are using a privileged port. For example, this allows the hosts "fred" and "wilma" to connect to MoM:

```
$clienthost fred
```

```
$clienthost wilma
```

The following hostnames are added to *\$clienthost* automatically: the server, the localhost, and if configured, the secondary server. The server sends each MoM a list of the hosts in the nodes file, and these are added internally to *\$clienthost*. None of these hostnames need to be listed in the configuration file.

Two hostnames are always allowed to connect to `pbs_mom`, "localhost" and the name returned to MoM by the system call `gethostname()`. These hostnames do not need to be added to the MoM configuration file.

The hosts listed as "clienthosts" make up a "sisterhood" of machines. Any one of the sisterhood will accept connections from within the sisterhood. The sisterhood must all use the same port number.

**\$cputmult <factor>**

This sets a factor used to adjust CPU time used by each job. This allows adjustment of time charged and limits enforced where jobs run on a system with different CPU performance. If MoM's system is faster than the reference system, set factor to a decimal value greater than 1.0. For example:

```
$cputmult 1.5
```

If MoM's system is slower, set factor to a value between 1.0 and 0.0. For example:

```
$cputmult 0.75
```

**\$dce\_refresh\_delta <delta>**

**Obsolete** (2020.1)

Defines the number of seconds between successive refreshings of a job's DCE login context. For example:

```
$dce_refresh_delta 18000
```

**\$enforce <limit>**

MoM will enforce the given *limit*. Some limits have associated values. Syntax:

```
$enforce <variable name> <value>
```

**\$enforce mem**

MoM will enforce each job's memory limit.

**\$enforce cpuaverage**

MoM will enforce ncpus when the average CPU usage over a job's lifetime usage is greater than the job's limit.

**\$enforce average\_trialperiod <seconds>**

Modifies cpuaverage. Minimum number of seconds of job walltime before enforcement begins.

Format: *Integer*

Default: 120

**\$enforce average\_percent\_over <percentage>**

Modifies cpuaverage. Gives percentage by which a job may exceed its ncpus limit.

Format: *Integer*

Default: 50

**\$enforce average\_cpufactor <factor>**

Modifies cpuaverage. The ncpus limit is multiplied by *factor* to produce actual limit.

Format: *Float*

Default: 1.025

**\$enforce cpuburst**

MoM will enforce the ncpus limit when CPU burst usage exceeds the job's limit.

**\$enforce delta\_percent\_over <percentage>**

Modifies cpuburst. Gives percentage over limit to be allowed.

Format: *Integer*

Default: 50

**\$enforce delta\_cpufactor <factor>**

Modifies cpuburst. The ncpus limit is multiplied by *factor* to produce actual limit.

Format: *Float*

Default: 1.5

**\$enforce delta\_weightup <factor>**

Modifies cpuburst. Weighting factor for smoothing burst usage when average is increasing.

Format: *Float*

Default: 0.4

**\$enforce\_delta\_weightdown** <factor>

Modifies *cpuburst*. Weighting factor for smoothing burst usage when average is decreasing.

Format: *Float*

Default: *0.4*

**\$ideal\_load** <load>

Defines the *load* below which the vnode is not considered to be busy. Used with the **\$max\_load** directive.

Example:

`$ideal_load 1.8`

Format: *Float*

No default

**\$jobdir\_root** <stage directory root | PBS\_USER\_HOME> [shared]

Directory under which PBS creates job-specific staging and execution directories when a job's **sandbox** attribute is set to *PRIVATE* and this attribute is set to an existing directory. If **\$jobdir\_root** is unset, the root directory for the job-specific staging and execution directory defaults to each job owner's home directory. If *stage directory root* does not exist when MoM starts up, MoM will abort. If *stage directory root* does not exist when MoM tries to run a job, MoM will kill the job. Path must be owned by root, and permissions must be *1777*. On Windows, this directory should have *Full Control Permission* for the local Administrators group.

When you set **\$jobdir\_root** to a shared (e.g. NFS) directory, tell MoM it is shared by setting the *shared* directive after the directory name:

`$jobdir_root <directory name> shared`

If the user home directory is shared, tell MoM it is shared:

`$jobdir_root PBS_USER_HOME shared`

Otherwise sister MoMs can prematurely delete files and directories when nodes are released. This is because when sister nodes are released, those sister MoMs would normally clean up their own files upon release, but this could cause problems in a shared directory. So if **\$jobdir\_root** or submitter home directories are shared, you need to tell the sister MoMs not to do the cleanup, and let the primary execution host MoM clean up when the job is finished.

To tell PBS to create job staging and execution directories created under */r/shared*, so that each job gets */r/shared/<job-specific directory>*, put the following line in MoM's configuration file:

`$jobdir_root /r/shared`

To tell PBS to use */scratch* when it is a shared directory:

`$jobdir_root /r/shared shared`

To tell PBS to use shared submitter home directories:

`$jobdir_root PBS_USER_HOME shared`

To tell PBS to use non-shared submitter home directories, leave the **\$jobdir\_root** parameter blank.

**\$job\_launch\_delay**

When the primary MoM gets a job whose `tolerate_node_failures` attribute is set to *all* or *job\_start*, the primary MoM can wait to start the job (running the job script or executable) for up to a configured number of seconds. During this time, `execjob_prologue` hooks can finish and the primary MoM can check for communication problems with sister MoMs. You configure the number of seconds for the primary MoM to wait for hooks via the `job_launch_delay` configuration parameter in MoM's config file:

`$job_launch_delay <number of seconds to wait>`

Default: the sum of the values of the alarm attributes of any enabled `execjob_prologue` hooks. If there are no enabled `execjob_prologue` hooks, the default value is 30 seconds. For example, if there are two enabled `execjob_prologue` hooks, one with `alarm = 30` and one with `alarm = 60`, the default value of MoM's `job_launch_delay` is 90 seconds.

After all the `execjob_prologue` hooks have finished, or MoM has waited for the value of the `job_launch_delay` parameter, she starts the job.

**\$kbd\_idle <idle wait> <min use> <poll interval>**

Declares that the vnode will be used for batch jobs during periods when the keyboard and mouse are not in use.

*idle wait*

Time, in seconds, that the workstation keyboard and mouse must be idle before being considered available for batch jobs.

Must be set to non-zero value for cycle harvesting to be enabled.

Format: *Integer*

No default

*min use*

Time, in seconds, during which the workstation keyboard or mouse must continue to be in use before the workstation is determined to be unavailable for batch jobs.

Format: *Integer*

Default: *10*

*poll interval*

Interval, in seconds, at which MoM checks for keyboard and mouse activity.

Format: *Integer*

Default: *1*

Example:

`$kbd_idle 1800 10 5`

**\$logevent <mask>**

Sets the mask that determines which event types are logged by `pbs_mom`. To include all debug events, use `0xffffffff`. See ["Log Levels" on page 446 in the PBS Professional Administrator's Guide](#).

Default: 975

**\$max\_check\_poll <seconds>**

Maximum time between polling cycles, in seconds. See ["Configuring MoM Polling Cycle" on page 40 in the PBS Professional Administrator's Guide](#). Minimum recommended value: 30 seconds.

Minimum value: *1 second*

Default: *120 seconds*

Format: *Integer*

**\$max\_load <load> [suspend]**

Defines the load above which the vnode is considered to be *busy*. Used with the \$ideal\_load directive. No new jobs are started on a *busy* vnode.

The optional *suspend* directive tells PBS to suspend jobs running on the vnode if the load average exceeds the \$max\_load number, regardless of the source of the load (PBS and/or logged-in users). Without this directive, PBS will not suspend jobs due to load.

We recommend setting *load* to a value that is slightly higher than the number of CPUs, for example *.25 + ncpus*.

Example:

```
$max_load 3.5
```

Format: *Float*

Default: number of CPUs on machine

**\$max\_poll\_downtime <downtime>**

When mother superior detects that a sister mom has lost connectivity (e.g. MoM went down or the network is having problems) it waits *downtime* seconds for the sister to reconnect before it gives up and kills the job.

Format: *Integer*

Default: *five minutes*

**memreserved <megabytes>**

**Deprecated.** The amount of per-vnode memory reserved for system overhead. This much memory is deducted from the value of *resources\_available.mem* for each vnode managed by this MoM.

For example,

```
memreserved 16
```

Default: *OMB*

**\$min\_check\_poll <seconds>**

Minimum time between polling cycles, in seconds. Must be greater than zero and less than \$max\_check\_poll. See ["Configuring MoM Polling Cycle" on page 40 in the PBS Professional Administrator's Guide](#). Minimum recommended value: *10 seconds*.

Format: *Integer*

Minimum value: *1 second*

Default: *10 seconds*

**\$prologalarm <timeout>**

Defines the maximum number of seconds the prologue and epilogue may run before timing out.

Example:

```
$prologalarm 30
```

Format: *Integer*

Default: *30 seconds*

**\$reject\_root\_scripts { True | False }**

When set to *True*, MoM won't acquire any new hook scripts, and MoM won't run job scripts that would execute as root or Admin. However, MoM will run previously-acquired hooks that run as root.

Format: *Boolean*

Default: *False*



**\$restart\_background {True | False}**

Controls how MoM runs a restart script after checkpointing a job. When this option is set to *True*, MoM forks a child which runs the restart script. The child returns when all restarts for all the local tasks of the job are done. MoM does not block on the restart. When this option is set to *False*, MoM runs the restart script and waits for the result.

Format: *Boolean*

Default: *False*

**\$restart\_transmogrify {True | False}**

Controls how MoM runs a restart script after checkpointing a job.

When this option is set to *True*, MoM runs the restart script, replacing the session ID of the original task's top process with the session ID of the script.

When this option is set to *False*, MoM runs the restart script and waits for the result. The restart script must restore the original session ID for all the processes of each task so that MoM can continue to track the job.

When this option is set to *False* and the restart uses an external command, the configuration parameter *restart\_background* is ignored and treated as if it were set to *True*, preventing MoM from blocking on the restart.

Format: *Boolean*

Default: *False*

**\$restrict\_user {True | False}**

Controls whether users not submitting jobs have access to this machine. If value is *True*, restrictions are applied.

See *\$restrict\_user\_exceptions* and *\$restrict\_user\_maxsysid*.

Not supported on Windows.

Format: *Boolean*

Default: *False*

**\$restrict\_user\_exceptions <user list>**

Comma-separated list of users who are exempt from access restrictions applied by *\$restrict\_user*. Leading spaces within each entry are allowed. Maximum of 10 names.

**\$restrict\_user\_maxsysid <value>**

Any user with a numeric user ID less than or equal to *value* is exempt from restrictions applied by *\$restrict\_user*.

If *\$restrict\_user* is *True* and no *value* exists for *\$restrict\_user\_maxsysid*, PBS looks in */etc/login.defs*, if it exists, for the *value*. Otherwise the default is used.

Format: *Integer*

Default: 999

**\$restricted <hostname>**

The *hostname* is added to the list of hosts which are allowed to connect to MoM without being required to use a privileged port. Queries from the hosts in the restricted list are only allowed access to information internal to this host, such as load average, memory available, etc. They may not run shell commands.

Hostnames can be wildcarded. For example, to allow queries from any host from the domain "xyz.com":

```
$restricted *.xyz.com
```

**\$retain\_launcher\_jobs\_dir**

Specifies whether to retain job launcher directories.

The MoM uses a job launcher directory to contain essential files for job launch and to store any resultant traces or logs. You can retain these directories for debugging, or you can remove them to optimize storage. The location of the launcher directory is `$PBS_HOME/spool/<job ID>.<ja_task_id>`. The `ja_task_id` is the cgroups directory job array index, which is different from the PBS job array index. The cgroups job array index (`ja_task_id`) starts at `1`, not `0`, so it is offset from the PBS job array index by `1`. The PBS job array index still starts at `0`. All jobs, whether job array or not, have a `ja_task_id` starting at `1`.

Valid values:

**never**

The job directory is not retained after execution.

**always**

The job directory is always retained.

**on\_failure**

The job directory is retained only if job execution fails.

Default: *never*

**\$sister\_join\_job\_alarm**

When the primary MoM gets a job whose `tolerate_node_failures` attribute is set to *all* or *job\_start*, the primary MoM can wait to start the job for up to a configured number of seconds if the sister MoMs do not immediately acknowledge joining the job. This gives the sister MoMs more time to join the job. You configure the number of seconds for the primary MoM to wait for sister MoMs via the `sister_join_job_alarm` configuration parameter in MoM's config file:

```
$sister_join_job_alarm <number of seconds to wait>
```

Default: the sum of the values of the alarm attributes of any enabled `execjob_begin` hooks. If there are no enabled `execjob_begin` hooks, the default value is 30 seconds. For example, if there are two enabled `execjob_begin` hooks, one with `alarm = 30` and one with `alarm = 20`, the default value of MoM's `sister_join_job_alarm` is 50 seconds.

After all the sister MoMs have joined the job, or MoM has waited for the value of the `$sister_join_job_alarm` parameter, she starts the job.

**\$suspendsig <suspend signal> [resume signal]**

Alternate signal *suspend signal* is used to suspend jobs instead of `SIGSTOP`. Optional *resume signal* is used to resume jobs instead of `SIGCONT`.

**\$tmpdir <directory>**

Location where each job's scratch directory will be created.

PBS creates a temporary directory for use by the job, not by PBS. PBS creates the directory before the job is run and removes the directory and its contents when the job is finished. It is scratch space for use by the job. Permission must be `1777` on Linux, writable by *Everyone* on Windows.

Example:

```
$tmpdir /memfs
```

Default on Linux: `/var/tmp`

Default on Windows: value of the `TMP` environment variable

---

**\$usecp <hostname:source directory> <destination directory>**

MoM uses `/bin/cp` to deliver output files when the destination is a network mounted file system, or when the source and destination are both on the local host, or when the *source directory* can be replaced with the *destination directory* on *hostname*. Both *source directory* and *destination directory* are absolute pathnames of directories, not files.

Overrides PBS\_RCP and PBS\_SCP.

Use trailing slashes on both the source and destination. For example:

```
$usecp HostA:/users/work/myproj/ /sharedwork/proj_results/
```

**\$wallmult <factor>**

Each job's **walltime** usage is multiplied by *factor*. For example:

```
$wallmult 1.5
```



# Scheduler Parameters

This chapter lists scheduler configuration parameters. These parameters are found in each scheduler's configuration file, *PBS\_HOME/sched\_priv/sched\_config*.

## 4.1 Format of Scheduler Configuration File

### 4.1.1 Parameters with Separate Primetime and Non-primetime Specification

If a scheduler parameter can be specified separately for primetime and non-primetime, the format for the parameter is the following:

*name: value [prime | non\_prime | all | none]*

- The *name* field cannot contain any whitespace.
- The *value* field may contain whitespace if the string is double-quoted. *value* can be: *True* | *False* | <number> | <string>. "*True*" and "*False*" are not case-sensitive.
- The third field allows you to specify that the setting is to apply during primetime, non-primetime, all the time, or none of the time. A blank third field is equivalent to "*all*" which means that it applies to both primetime and non-primetime.

Acceptable values: "*all*", "*ALL*", "*none*", "*NONE*", "*prime*", "*PRIME*", "*non\_prime*", "*NON\_PRIME*"

### 4.1.2 Parameters without Separate Primetime and Non-primetime Specification

If a scheduler parameter cannot be specified separately for primetime and non-primetime, the format for the parameter is the same as the above, except that there is no third field.

### 4.1.3 Format Details

- Each entry must be a single, unbroken line.
- Entries must be quoted if they contain whitespace.
- Any line starting with a "#" is a comment, and is ignored.

## 4.2 Configuration Parameters

### backfill

**Deprecated.** Use the `backfill_depth` queue/server attribute instead. Toggle that controls whether PBS uses backfilling. If this is set to *True*, this scheduler attempts to schedule smaller jobs around higher-priority jobs when using `strict_ordering`, as long as running the smaller jobs won't change the start time of the jobs they were scheduled around. This scheduler chooses jobs in the standard order, so other high-priority jobs will be considered first in the set to fit around the highest-priority job.

Format: *Boolean*

Default: *True all*

### backfill\_prime

This scheduler will not run jobs which would overlap the boundary between primetime and non-primetime. This assures that jobs restricted to running in either primetime or non-primetime can start as soon as the time boundary happens.

See also `prime_spill`, `prime_exempt_anytime_queues`.

Format: *Boolean*

Default: *False all*

### by\_queue

If set to *True*, all jobs that can be run from the highest-priority queue are run, then any jobs that can be run from the next queue are run, and so on. Queues are ordered highest-priority first. If `by_queue` is set to *False*, all jobs are treated as if they are in one large queue. The `by_queue` parameter is overridden by the `round_robin` parameter when `round_robin` is set to *True*.

See ["Examining Jobs Queue by Queue" on page 115 in the PBS Professional Administrator's Guide](#).

Format: *Boolean*

Default: *True all*

### dedicated\_prefix

Queue names with this prefix are treated as dedicated queues, meaning jobs in that queue are considered for execution only when the system is in dedicated time as specified in the configuration file `PBS_HOME/sched_priv/dedicated_time`.

See ["Dedicated Time" on page 130 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *ded*

### fair\_share

Enables the fairshare algorithm, and turns on usage collecting. Jobs will be selected based on a function of their recent usage and priority (shares). Not a prime option.

See ["Using Fairshare" on page 141 in the PBS Professional Administrator's Guide](#).

Format: *Boolean*

Default: *False all*

### fairshare\_decay\_factor

Decay multiplier for fairshare usage reduction. Each decay period, the usage is multiplied by this value. Valid values: between 0 and 1, not inclusive. Not a prime option.

Format: *Float*

Default: 0.5

**fairshare\_decay\_time**

Time between fairshare usage decay operations. Not a prime option.

Format: *Duration*

Default: *24:00:00*

**fairshare\_entity**

Specifies the entity for which fairshare usage data will be collected. Can be one of "euser", "egroup", "Account\_Name", "queue", or "egroup:euser". Not a prime option.

Format: *String*

Default: *euser*

**fairshare\_enforce\_no\_shares**

If this option is set to *True*, jobs whose entity has zero shares will never run. When *False*, jobs whose entity has zero shares can run jobs only when no other entities have jobs that are available to run. Requires *fair\_share* parameter to be enabled. Not a prime option.

Format: *Boolean*

Default: *True*

**fairshare\_usage\_res**

Specifies the mathematical formula to use in fairshare calculations. Is composed of PBS resources as well as mathematical operators that are standard Python operators and/or those in the Python math module. When using a PBS resource, if *resources\_used.<resource name>* exists, that value is used. Otherwise, the value is taken from *Resource\_List.<resource name>*. Not a prime option.

See ["Tracking Resource Usage" on page 145 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *"cput"*

**half\_life**

**Deprecated** (as of 13.0).

The half-life for fairshare usage; after the amount of time specified, the fairshare usage is halved. Requires that *fair\_share* parameter be enabled. Not a prime option.

See ["Using Fairshare" on page 141 in the PBS Professional Administrator's Guide](#).

Format: *Duration*

Default: *24:00:00*

**job\_sort\_key**

Specifies how jobs should be sorted. *job\_sort\_key* can be used to sort using either (a) resources or (b) special case sorting routines. Multiple *job\_sort\_key* entries can be used, one to a line, in which case the first entry will be the primary sort key, the second will be used to sort equivalent items from the first sort, etc. This attribute is overridden by the *job\_sort\_formula* attribute. If both are set, *job\_sort\_key* is ignored and an error message is printed.

Syntax:

*job\_sort\_key: "<resource name> HIGH|LOW"*

*job\_sort\_key: "fairshare\_perc HIGH|LOW"*

*job\_sort\_key: "job\_priority HIGH|LOW"*

Options: One of the following is required.

**HIGH**

Specifies descending sort.

**LOW**

Specifies ascending sort.

There are three special case sorting routines, which can be used instead of *resource name*:

**Table 4-1: Special Sorting in job\_sort\_key**

| Special Sort                  | Description   |
|-------------------------------|---|
| <i>fairshare_perc HIGH</i>    | Sort based on how much fairshare percentage the entity deserves, based on the values in the <code>resource_group</code> file. If user A has more priority than user B, all of user A's jobs will always be run first. Past history is not used. For calculation, see <a href="#">"Computing Target Usage for Each Vertex (fairshare_perc)" on page 147 in the PBS Professional Administrator's Guide</a> .<br><br>This should only be used if entity share (strict priority) sorting is needed. See <a href="#">"Sorting Jobs by Entity Shares (Was Strict Priority)" on page 135 in the PBS Professional Administrator's Guide</a><br><br>Incompatible with <code>fair_share</code> scheduling parameter being <i>True</i> . |
| <i>job_priority HIGH LOW</i>  | Sort jobs by the job priority attribute regardless of job owner.  |
| <i>sort_priority HIGH LOW</i> | <b>Deprecated.</b> See <code>job_priority</code> above.   |

The following example illustrates how to sort jobs so that those with high CPU count come first:

```
job_sort_key: "ncpus HIGH" all
```

The following example shows how to sort jobs so that those with lower memory come first:

```
job_sort_key: "mem LOW" prime
```

Format: *Quoted string*

Default: Not enforced

**load\_balancing**

**Removed** (2022.1).

**load\_balancing\_rr**

**Removed.**

**log\_filter**

**Obsolete.** See ["log\\_events" on page 304 of the PBS Professional Reference Guide](#).

**mom\_resources**

**Removed** as of 2022.1.0.

**node\_sort\_key**

Defines sorting on resource or priority values on vnodes. Resource must be numerical, for example, *long* or *float*. Up to 20 `node_sort_key` entries can be used, in which case the first entry will be the primary sort key, the second will be used to sort equivalent items from the first sort, etc.

Syntax:

```
node_sort_key: <resource name> | sort_priority <HIGH | LOW>
```

```
node_sort_key: <resource name> <HIGH | LOW> <total | assigned | unused>
```

where

*total*

Use the `resources_available` value. This is the default setting when sorting on a resource.



*assigned*

Use the `resources_assigned` value.

*unused*

Use the value given by `resources_available - resources_assigned`.

*sort\_priority*

Sort vnodes by the value of the vnode priority attribute.

When sorting on a resource, the default third field is *"total"*.

See ["Sorting Vnodes on a Key" on page 226 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *node\_sort\_key: "sort\_priority HIGH all"*

**nonprimetime\_prefix**

Queue names which start with this prefix are treated as non-primetime queues. Jobs in these queues run only during non-primetime. Primetime and non-primetime are defined in the `holidays` file.

See ["Using Primetime and Holidays" on page 192 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *np\_*

**peer\_queue**

Defines the mapping of a pulling queue to a furnishing queue for peer scheduling. Maximum number is 50 peer queues per scheduler.

See ["Peer Scheduling" on page 166 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: Unset

**preemptive\_sched**

Enables job preemption.

See `preempt_order` and ["Using Preemption" on page 182 in the PBS Professional Administrator's Guide](#) for details.

Format: *String*

Default: *True all*

**preempt\_order**

**No longer available.** Use the `preempt_sort` scheduler attribute. See ["preempt\\_order" on page 305.](#)

**preempt\_prio**

**No longer available.** Use the `preempt_sort` scheduler attribute. See ["preempt\\_prio" on page 305.](#)

**preempt\_queue\_prio**

**No longer available.** Use the `preempt_sort` scheduler attribute. See ["preempt\\_queue\\_prio" on page 306.](#)

**preempt\_sort**

**No longer available.** Use the `preempt_sort` scheduler attribute. See ["preempt\\_sort" on page 306.](#)

**primetime\_prefix**

Queue names starting with this prefix are treated as primetime queues. Jobs in these queues run only during primetime. Primetime and non-primetime are defined in the `holidays` file.

See ["Using Primetime and Holidays" on page 192 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *p\_*

**prime\_exempt\_anytime\_queues**

Determines whether *anytime* queues are controlled by `backfill_prime`.

If set to *True*, jobs in an *anytime* queue are not prevented from running across a primetime/non-primetime or non-primetime/primetime boundary.

If set to *False*, the jobs in an *anytime* queue may not cross this boundary, except for the amount specified by their `prime_spill` setting.

See also `backfill_prime`, `prime_spill`.

Format: *Boolean*

Default: *False*

**prime\_spill**

Specifies the amount of time a job can spill over from non-primetime into primetime or from primetime into non-primetime. This option can be separately specified for primetime and non-primetime. This option is only meaningful if `backfill_prime` is *True*.

See also `backfill_prime`, `prime_exempt_anytime_queues`.

For example, non-primetime jobs can spill into primetime by 1 hour:

```
prime_spill: 1:00:00 prime
```

For example, jobs in either prime/non-prime can spill into the other by 1 hour:

```
prime_spill: 1:00:00 all
```

Format: *Duration*

Default: *00:00:00*

**provision\_policy**

Specifies how vnodes are selected for provisioning. Can be set by Manager only; readable by all. Can be set to one of the following:

**avoid\_provision**

PBS first tries to satisfy the job's request from free vnodes that already have the requested AOE instantiated. PBS uses `node_sort_key` to sort these vnodes.

If PBS cannot satisfy the job's request using vnodes that already have the requested AOE instantiated, PBS uses the server's `node_sort_key` to select the free vnodes that must be provisioned in order to run the job, choosing from any free vnodes, regardless of which AOE is instantiated on them.

Of the selected vnodes, PBS provisions any that do not have the requested AOE instantiated on them.

**aggressive\_provision**

PBS selects vnodes to be provisioned without considering which AOE is currently instantiated.

PBS uses the server's `node_sort_key` to select the vnodes on which to run the job, choosing from any free vnodes, regardless of which AOE is instantiated on them. Of the selected vnodes, PBS provisions any that do not have the requested AOE instantiated on them.

Format: *String*

Default: *aggressive\_provision*

**resources**

Specifies those resources which are not to be over-allocated, or if Boolean are to be honored, when scheduling jobs. Vnode-level Boolean resources are automatically honored and do not need to be listed here. Limits are set by setting `resources_available.<resource name>` on vnodes, queues, and the server. A scheduler considers numeric (integer or float) items as consumable resources and ensures that no more are assigned than are available (e.g. `ncpus` or `mem`). Any string resources are compared using string comparisons. If "host" is not added to the `resources` line, when the user submits a job requesting a specific vnode in the following syntax:

```
qsub -l select=host=vnodeName
```

the job will run on any host.

Format: *String*

Default: *ncpus, mem, arch, host, vnode, aoe*

**resource\_unset\_infinite**

Resources in this list are treated as infinite if they are unset. Cannot be set differently for primetime and non-primetime.

Example:

```
resource_unset_infinite: "vmem, foo_licenses"
```

Format: *Comma-delimited list of resources*

Default: Empty list

**round\_robin**

If set to *True*, this scheduler considers one job from the first queue, then one job from the second queue, and so on in a circular fashion. The queues are ordered with the highest-priority queue first. Each scheduling cycle starts with the same highest-priority queue, which will therefore get preferential treatment.

If there are groups of queues with the same priority, and this parameter is set to *True*, this scheduler round-robins through each group of queues before moving to the next group.

If `round_robin` is set to *False*, this scheduler considers jobs according to the setting of the `by_queue` parameter.

When *True*, overrides the `by_queue` parameter.

Format: *Boolean*

Default: *False all*

**server\_dyn\_res**

Directs this scheduler to replace the server's `resources_available` values with new values returned by a site-specific external script or program.

See ["Creating Server Dynamic Resource Scripts" on page 265 in the PBS Professional Administrator's Guide](#) for details of how to use this parameter.

Default timeout for server dynamic resource scripts is 30 seconds. You can configure this in the scheduler `server_dyn_res_alarm` attribute.

Format: *String*

Default: Unset

**smp\_cluster\_dist**

**Deprecated** (12.2). Specifies how single-host jobs should be distributed to all hosts of the complex.

Options:

**pack**

Keep putting jobs onto one host until it is full and then move on to the next.

**round\_robin**

Put one job on each vnode in turn before cycling back to the first one.

See ["SMP Cluster Distribution" on page 219 in the PBS Professional Administrator's Guide](#) and ["Using Load Balancing" on page 161 in the PBS Professional Administrator's Guide](#).

Format: *String*

Default: *pack all*

**strict\_fifo**

**Deprecated.** Use `strict_ordering`.

**strict\_ordering**

Specifies that jobs must be run in the order determined by whatever sorting parameters are being used. This means that a job cannot be skipped due to resources required not being available. If a job due to run next cannot run, no job will run, unless backfilling is used, in which case jobs can be backfilled around the job that is due to run next.

See ["FIFO with Strict Ordering" on page 153 in the PBS Professional Administrator's Guide](#).

Example line in `PBS_HOME/sched_priv/sched_config`:

```
strict_ordering: True ALL
```

Format: *Boolean*

Default: *False all*

**unknown\_shares**

The number of shares for the *unknown* group. These shares determine the portion of a resource to be allotted to that group via fairshare. Requires `fair_share` to be enabled.

See ["Using Fairshare" on page 141 in the PBS Professional Administrator's Guide](#).

Format: *Integer*

Default: The unknown group gets 0 shares

# List of Built-in Resources

This chapter lists all of the built-in PBS resources. For information on setting, viewing, and using resources, see ["Using PBS Resources" on page 229 in the PBS Professional Administrator's Guide](#).

## 5.1 Resource Data Types

Data types for resources are described in [section 7.2, "Resource Formats", on page 363](#).

### Boolean

Name of Boolean resource is a string.

Values:

*TRUE, True, true, T, t, Y, y, 1*

*FALSE, False, false, F, f, N, n, 0*

### Duration

A period of time, expressed either as

*An integer whose units are seconds*

or

*[[hours:]minutes:]seconds[.milliseconds]*

in the form:

*[[[HH]HH:]MM:]SS[.milliseconds]*

Milliseconds are rounded to the nearest second.

### Float

Floating point. Allowable values: *[+-] 0-9 [[0-9] ...] . [[0-9] ...]*

### Long

Long integer. Allowable values: *0-9 [[0-9] ...], and + and -*

`<queue name>@<server name>`

### Size

Number of bytes or words. The size of a word is 64 bits.

Format: `<integer>[<suffix>]`

where *suffix* can be one of the following:

**Table 5-1: Size in Bytes**

| Suffix   | Meaning                | Size                                  |
|----------|------------------------|---------------------------------------|
| b or w   | Bytes or words         | 1                                     |
| kb or kw | Kilobytes or kilowords | 2 to the 10th, or 1024                |
| mb or mw | Megabytes or megawords | 2 to the 20th, or 1,048,576           |
| gb or gw | Gigabytes or gigawords | 2 to the 30th, or 1,073,741,824       |
| tb or tw | Terabytes or terawords | 2 to the 40th, or 1024 gigabytes      |
| pb or pw | Petabytes or petawords | 2 to the 50th, or 1,048,576 gigabytes |

Default: *bytes*

Note that when sorting vnodes, a scheduler rounds all resources of type **size** up to the nearest kb.

### String

Any character, including the space character.

Only one of the two types of quote characters, " or ', may appear in any given value.

Values: `[_a-zA-Z0-9][[_a-zA-Z0-9 ! " # $ % ' ( ) * + , - . / : ; < = > ? @ [ \ ] ^ _ ' { | } ~] ...]`

String resource values are case-sensitive. No limit on length.

### String Array

Comma-separated list of strings.

Strings in `string_array` may not contain commas. No limit on length.

Python type is *str*.

A string array resource with one value works exactly like a string resource.

## 5.2 Viewing Resource Information

You can see attribute values of resources for the server, queues, and vnodes using the `qmgr` or `pbsnodes` commands. The value in the server, queue, or vnode `resources_assigned` attribute is the amount explicitly requested by running and exiting jobs and, at the server and vnodes, started reservations.

You can see job attribute values using the `qstat` command. The value in the job's `Resource_List` attribute is the amount explicitly requested by the job. See ["Resources Requested by Job" on page 243 in the PBS Professional Administrator's Guide](#).

The following table summarizes how to find resource information:

**Table 5-2: How to View Resource Information**

| Location       | Item to View  | Command   |
|----------------|---|---|
| server         | default_chunk, default_qsub_arguments, resources_available, resources_assigned, resources_default | <a href="#">qmgr</a> , <a href="#">qstat</a> , <a href="#">pbsnodes</a> |
| scheduler      | sched_config file   | Favorite editor or viewer   |
| queues         | default_chunk, resources_available, resources_assigned, resources_default                         | <a href="#">qmgr</a> , <a href="#">qstat</a>                            |
| MoM and vnodes | resources_available, sharing, pcpus, resources_assigned   | <a href="#">qmgr</a> , <a href="#">pbsnodes</a>                         |
|                | mom_config file   | Favorite editor or viewer   |
| job            | Resource_List   | <a href="#">qstat</a>   |
| reservation    | Resource_List   | <a href="#">pbs_rstat</a> -f  |
| accounting     | resources_assigned entry in accounting log  | Favorite editor or viewer   |

---

Every consumable resource, for example mem, can appear in four PBS attributes. These attributes are used in the following elements of PBS:

**Table 5-3: Values Associated with Consumable Resources**

| Attribute           | Vnode | Queue | Server | Accounting Log | Job | Scheduler |
|---------------------|-------|-------|--------|----------------|-----|-----------|
| resources_available | Yes   | Yes   | Yes    |                |     | Yes       |
| resources_assigned  | Yes   | Yes   | Yes    | Yes            |     |           |
| resources_used      |       |       |        | Yes            | Yes | Yes       |
| Resource_List       |       |       |        |                | Yes | Yes       |

## 5.3 Resource Flags

Resource flags are described and listed in ["Specifying Resource Level and Consumability" on page 257 in the PBS Professional Administrator's Guide](#).



## 5.4 Attributes where Resources Are Tracked

Resources are tracked in the following attributes:

**Table 5-4: Attributes Where Resources Are Tracked**

| Resource Being Tracked   | Attribute Name                      |                                     |                                |             |
|--|-------------------------------------|-------------------------------------|--------------------------------|-------------|
|  | Server and Queue                    | Vnode                               | Job                            | Reservation |
| Amount of each resource available for use at the object (server, queue, vnode)   | resources_available.<resource name> | resources_available.<resource name> |                                |             |
| Amount of each resource allocated to jobs running and exiting at the object (server, queue, vnode)                               | resources_assigned.<resource name>  | resources_assigned.<resource name>  |                                |             |
| Amount of each resource used by the job  |                                     |                                     | resources_used.<resource name> |             |
| Amount of each job-wide resource that is assigned to any job that does not explicitly request the resource                       | resources_default.<resource name>   |                                     |                                |             |
| Amount of each host-level resource that is assigned to each chunk of any job where that does not explicitly request the resource | default_chunk.<resource name>       |                                     |                                |             |

Table 5-4: Attributes Where Resources Are Tracked

| Resource Being Tracked   | Attribute Name   |       |                               |                               |
|--|------------------|-------|-------------------------------|-------------------------------|
|  | Server and Queue | Vnode | Job                           | Reservation                   |
| List of resources requested by the object (job or reservation)   |                  |       | Resource_List.<resource name> | Resource_List.<resource name> |
| List of chunks for the job. Each chunk shows the name of the vnode from which it is taken along with the host-level, consumable resources allocated from that vnode. |                  |       | exec_vnode                    |                               |
| List of vnodes and resources allocated to them to satisfy the chunks requested for this reservation or occurrence  |                  |       |                               | resv_nodes                    |

## 5.5 Resource Table Format

In the following tables, the columns contain the following information:

**Name**

The name of the resource

**Description**

A description of the resource's function

**Format**

The resource's format

**Scope**

Some resources are either:

- Job-wide and can be requested only outside of a select statement
- Host-level and can be requested only inside of a select statement

**Consumable**

A resource is consumable if use of this resource by a job reduces the amount available to other jobs

**Val/Opt**

If the resource can take only specific values or options, each is listed here

**Value/Option Description**

If the resource can take only specific values or options, the behavior of each value or option is described here

**Default Value**

The resource's default value, if any

**Python Type**

The resource's Python type

**Platform**

Platform where available

## 5.6 Resources Built Into PBS

| Resources  |                     |            |            |                                      |                             |                  |             |          |
|--|---------------------|------------|------------|--------------------------------------|-----------------------------|------------------|-------------|----------|
| Name<br>Description  | Format              | Scope      | Consumable | Val / Opt                            | Value/Option<br>Description | Default<br>Value | Python Type | Platform |
| <b>aoe</b><br>List of AOE's (Application Operating Environments) that can be instantiated on this vnode. Case-sensitive. An AOE is the environment that results from provisioning a vnode. Each job can request at most one AOE. Cannot be set on server's host. | <i>string array</i> | Host-level | No         | Allowable values are site-dependent. |                             | No default       | str         |          |

## List of Built-in Resources

| Resources  |                                 |            |            |                     |                             |                  |              |                    |
|--|---------------------------------|------------|------------|---------------------|-----------------------------|------------------|--------------|--------------------|
| Name<br>Description  | Format                          | Scope      | Consumable | Val / Opt           | Value/Option<br>Description | Default<br>Value | Python Type  | Platform           |
| <b>arch</b><br>System architecture. One architecture can be defined for a vnode. One architecture can be requested per vnode. Allowable values and effect on job placement are site-dependent. The <code>resources_available.arch</code> resource is the value reported by MoM unless explicitly set by the administrator. | <i>String</i>                   | Host-level | No         | <i>linux</i>        | Linux                       | No default       | str          | Linux              |
|  |                                 |            |            | <i>linux_cpuset</i> | Linux with cpusets          |                  |              | Linux with cpusets |
|  |                                 |            |            | <i>XT</i>           | CLE                         |                  |              | CLE                |
|  |                                 |            |            | <i>windows</i>      | Windows                     |                  |              | Windows            |
| <b>container_engine</b><br>Specifies container engine(s) for a host.   | <i>string array</i>             | Host-level |            |                     |                             | No default       | str          |                    |
| <b>container_image</b><br>Specifies image for container. Overrides <code>CONTAINER_IMAGE</code> environment variable.  | <i>string</i>                   | Host-level |            |                     |                             | No default       | str          |                    |
| <b>container_ports</b><br>Comma-separated list of ports. For single-vnode jobs in Docker containers, can be used to specify ports for applications. PBS maps the requested ports to available ports on the host and returns the mapping.   | <i>string array</i>             | Host-level |            |                     |                             | No default       |              |                    |
| <b>cput</b><br>Amount of CPU time used by the job for all processes on all vnodes. Establishes a job-wide resource limit.  | <i>Duration</i>                 | Job-wide   | No         |                     |                             | No default       | pbs.duration |                    |
| <b>energy</b><br>The energy used by a job. Set by PBS.   | <i>Float.</i> Units: <i>kWh</i> |            | Yes        |                     |                             | No default       |              |                    |

| Resources  |                     |            |            |           |   |  |             |          |
|--|---------------------|------------|------------|-----------|---|--|-------------|----------|
| Name<br>Description  | Format              | Scope      | Consumable | Val / Opt | Value/Option<br>Description                   | Default<br>Value   | Python Type | Platform |
| <b>eo</b><br>Stands for "Energy Operational Environment".<br>When set on a vnode in <code>resources_available.eo</code> , contains the list of available power profiles.<br>When set for a job in <code>Resource_List.eo</code> , can contain at most one power profile. (A job can request only one power profile.)<br>Automatically added to <code>resources:</code> line in <code>sched_config</code> . | <i>string array</i> |            | No         |           |   | For <code>resources_available.eo</code> : <i>unset</i><br>For <code>Resource_List.eo</code> : no default | str         |          |
| <b>exec_vnode</b><br>The vnodes that PBS estimates this job will use.<br>This is not the job's <code>exec_vnode</code> attribute. This appears only in job's <code>estimated</code> attribute.<br>Cannot be requested for a job; used for reporting only. Read-only.   | <i>String</i>       |            |            |           |   | No default   | str         |          |
| <b>file</b><br>Size of any single file that may be created by the job.<br>A scheduler rounds all resources of type <code>size</code> up to the nearest kb.   | <i>Size</i>         | Job-wide   |            |           |   | No default   | pbs.size    |          |
| <b>gpu_usage</b><br>GPU usage reported per MoM   | <i>String</i>       | Job-wide   | No         |           |   | No default   | str         |          |
| <b>hbm</b><br>High-bandwidth memory. Available only on some architectures.   | <i>Size</i>         | Host-level | Yes        |           | Values must be greater than or equal to zero. | No default   | pbs.size    |          |
| <b>host</b><br>Name of execution host. Site-dependent.   | <i>String</i>       | Host-level |            |           |   | Automatically set to the short form of the hostname in the Mom attribute.                                | str         |          |
| <b>lic_signature</b><br>Contains licensing information.  | <i>String</i>       | Host-level |            |           |   |  | str         |          |

## List of Built-in Resources

| Resources  |                 |  |            |  |                             |                  |                           |          |
|--|-----------------|--|------------|--|-----------------------------|------------------|---------------------------|----------|
| Name<br>Description  | Format          | Scope  | Consumable | Val / Opt  | Value/Option<br>Description | Default<br>Value | Python Type               | Platform |
| <b>max_walltime</b><br>Maximum walltime allowed for a shrink-to-fit job. Job's actual walltime is between <code>max_walltime</code> and <code>min_walltime</code> . PBS sets walltime for a shrink-to-fit job. If <code>max_walltime</code> is specified, <code>min_walltime</code> must also be specified. Cannot be used for <code>resources_min</code> or <code>resources_max</code> . Cannot be set on job arrays or reservations. | <i>Duration</i> | Job-wide   | No         | Must be greater than or equal to <code>min_walltime</code> . |                             | <i>5 years</i>   | <code>pbs.duration</code> |          |
| <b>mem</b><br>Amount of physical memory i.e. workingset allocated to the job, either job-wide or host-level.<br>A scheduler rounds all resources of type <code>size</code> up to the nearest kb.   | <i>Size</i>     | Either job-wide or host-level. Can be requested only inside of a select statement. | Yes        |  |                             | No default       | <code>pbs.size</code>     |          |
| <b>min_walltime</b><br>Minimum walltime allowed for a shrink-to-fit job. When <code>min_walltime</code> is specified, job is a shrink-to-fit job. If this attribute is set, PBS sets the job's walltime. Job's actual walltime is between <code>max_walltime</code> and <code>min_walltime</code> . Cannot be used for <code>resources_min</code> or <code>resources_max</code> . Cannot be set on job arrays or reservations.         | <i>Duration</i> | Job-wide   | No         | Must be less than or equal to <code>max_walltime</code> .    |                             | No default       | <code>pbs.duration</code> |          |

| Resources  |                |            |            |           |                             |  |             |          |
|--|----------------|------------|------------|-----------|-----------------------------|--|-------------|----------|
| Name<br>Description  | Format         | Scope      | Consumable | Val / Opt | Value/Option<br>Description | Default<br>Value                                 | Python Type | Platform |
| <b>mpiprocs</b><br>Number of MPI processes for this chunk. Cannot use sum from chunks as job-wide limit.<br>The number of lines in <code>PBS_NODEFILE</code> is the sum of the values of <code>mpiprocs</code> for all chunks requested by the job. For each chunk with <code>mpiprocs=P</code> , the host name for that chunk is written to the <code>PBS_NODEFILE</code> <i>P</i> times.   | <i>Integer</i> | Host-level |            |           |                             | If <code>ncpus &gt; 0</code> : 1<br>Otherwise: 0 | int         |          |
| <b>nchunk</b><br>Number of chunks requested between plus symbols in a select statement. For example, if the select statement is <code>-lselect 4:ncpus=2+12:ncpus=8</code> , the value of <code>nchunk</code> for the first part is 4, and for the second part it is 12. The <code>nchunk</code> resource cannot be named in a select statement; it can only be specified by placing a number before the colon, as in the above example. When the number is omitted, <code>nchunk</code> is 1.<br>This resource can be used to specify the default number of chunks at the server or queue. Example: <code>set queue myqueue default_chunk.nchunk=2</code><br>This resource cannot be used in server and queue <code>resources_min</code> and <code>resources_max</code> . | <i>Integer</i> |            | No         |           |                             | 1  | int         |          |
| <b>ncpus</b><br>Number of processors.  | <i>Integer</i> | Host-level | Yes        |           |                             | No default                                       | int         |          |
| <b>ngpus</b><br>Number of GPUs.  | <i>Integer</i> | Host-level | Yes        |           |                             | No default                                       | int         |          |

## List of Built-in Resources

| Resources   |                 |            |            |           |                             |                       |                     |          |
|---|-----------------|------------|------------|-----------|-----------------------------|-----------------------|---------------------|----------|
| Name<br>Description   | Format          | Scope      | Consumable | Val / Opt | Value/Option<br>Description | Default<br>Value      | Python Type         | Platform |
| <b>nice</b><br>Nice value with which the job is to be run. Host-dependent.  | <i>Integer</i>  | Job-wide   |            |           |                             | No default            | int                 |          |
| <b>nodect</b><br><b>Deprecated.</b> Number of chunks in resource request from selection directive, or number of hosts requested from node specification. Read-only.   | <i>Integer</i>  | Job-wide   |            |           |                             | 1                     | int                 |          |
| <b>nodes</b><br><b>Deprecated.</b> Number of hosts requested.   | <i>Integer</i>  |            |            |           |                             | No default            |                     |          |
| <b>ompthreads</b><br>Number of OpenMP threads for this chunk.<br>Cannot use sum from chunks as job-wide limit.<br>For the MPI process with rank 0, the environment variables <b>NCPUS</b> and <b>OMP_NUM_THREADS</b> are set to the value of <b>ompthreads</b> .<br>For other MPI processes, behavior is dependent on MPI implementation. | <i>Integer</i>  | Host-level | No         |           |                             | Value of <b>ncpus</b> | int                 |          |
| <b>pcput</b><br>Amount of CPU time allocated to any single process in the job. Establishes a per-process resource limit.  | <i>Duration</i> | Job-wide   | No         |           |                             | No default            | <b>pbs.duration</b> |          |
| <b>pmem</b><br>Amount of physical memory (workingset) for use by any single process of the job. Establishes a per-process resource limit.<br>A scheduler rounds all resources of type <b>size</b> up to the nearest kb.   | <i>Size</i>     | Job-wide   | No         |           |                             | No default            | <b>pbs.size</b>     |          |



| Resources   |   |          |            |  |                             |                  |              |          |
|---|---|----------|------------|--|-----------------------------|------------------|--------------|----------|
| Name<br>Description   | Format  | Scope    | Consumable | Val / Opt  | Value/Option<br>Description | Default<br>Value | Python Type  | Platform |
| <b>preempt_targets</b><br>List of resources and/or queues. Jobs requesting those resources or in those queues are preemption targets.   | <i>string array</i><br>Syntax:<br><code>preempt_targets="Queue=&lt;queue name&gt;[,Queue=&lt;queue name&gt;],Resource_List.&lt;resource&gt;=&lt;value&gt;[,Resource_List.&lt;resource&gt;=&lt;value&gt;]"</code><br>or<br><code>preempt_targets=None</code><br>Keywords "queue" and "none" are case-insensitive. You can list multiple comma-separated targets. | Job-wide | No         |  |                             | No default       | str          |          |
| <b>pvmem</b><br>Amount of virtual memory for use by any single process in the job. Establishes a per-process resource limit. A scheduler rounds all resources of type <code>size</code> up to the nearest kb. | <i>Size</i>   | Job-wide | No         |  |                             | No default       | pbs.size     |          |
| <b>site</b><br>Arbitrary string resource.   | <i>String</i>   | Job-wide | No         |  |                             | No default       | str          |          |
| <b>software</b><br>Site-specific software specification.  | <i>String</i>   | Job-wide |            | Allowable values and effect on job placement are site-dependent. |                             | No default       | pbs.software |          |

## List of Built-in Resources

| Resources   |                 |            |            |           |                             |                  |              |          |
|---|-----------------|------------|------------|-----------|-----------------------------|------------------|--------------|----------|
| Name<br>Description   | Format          | Scope      | Consumable | Val / Opt | Value/Option<br>Description | Default<br>Value | Python Type  | Platform |
| <b>soft_walltime</b><br>Soft limit on walltime. Similar to <b>walltime</b> , but cannot be requested by unprivileged users, and job is not killed if it exceeds its <b>soft_walltime</b> . A job's <b>soft_walltime</b> cannot exceed its <b>walltime</b> . Can be set by Manager only. | <i>Duration</i> |            |            |           |                             | No default       | pbs.duration |          |
| <b>start_time</b><br>The estimated start time for this job. Cannot be requested for a job; used for reporting only.<br>Appears only in job's <b>estimated</b> attribute. Read-only.   | <i>Integer</i>  |            |            |           |                             | No default       | int          |          |
| <b>swap</b><br>Amount of swap space for use by all concurrent processes in the job. Establishes a per-chunk resource limit.<br>A scheduler rounds all resources of type <b>size</b> up to the nearest kb.<br>Used only when PBS is using cgroups with the memsw controller enabled.     | <i>Size</i>     | Host-level | Yes        |           |                             | No default       | pbs.size     |          |
| <b>vmem</b><br>Amount of virtual memory for use by all concurrent processes in the job. Establishes a per-chunk resource limit.<br>A scheduler rounds all resources of type <b>size</b> up to the nearest kb.<br>Used only when PBS is not using cgroups.                               | <i>Size</i>     | Host-level | Yes        |           |                             | No default       | pbs.size     |          |

| Resources   |                     |            |            |           |                             |                  |              |          |
|---|---------------------|------------|------------|-----------|-----------------------------|------------------|--------------|----------|
| Name<br>Description   | Format              | Scope      | Consumable | Val / Opt | Value/Option<br>Description | Default<br>Value | Python Type  | Platform |
| <b>vnode</b><br>Name of virtual node (vnode) on which to execute. Site-dependent. See <a href="#">“Vnode Attributes” on page 325 of the PBS Professional Reference Guide.</a> | <i>String</i>       | Host-level |            |           |                             | No default       | str          |          |
| <b>vntype</b><br>The type of the vnode.   | <i>string array</i> | Host-level | No         |           |                             | No default       | str          | all      |
| <b>walltime</b><br>Amount of wall-clock time. Establishes a job-wide resource limit. Actual elapsed time may differ from <b>walltime</b> during Daylight Savings transitions. | <i>Duration</i>     | Job-wide   | No         |           |                             | 5 years          | pbs.duration |          |



# Attributes

This chapter lists all of the supported PBS attributes. Attributes are listed by the PBS object they modify. For example, all supported attributes of jobs are listed in [section 6.11, “Job Attributes”, on page 332](#). Attributes are case-sensitive.

## 6.1 Attribute Behavior

- When you set the value of most attributes, the change takes place immediately. You do not need to restart any daemons in order to make the change.
- When an attribute is unset, it behaves as if it is at its default value.

## 6.2 How To Set Attributes

You set most attributes via the `qmgr` command. You can set vnode attributes during vnode creation (see [“Creating Vnodes” on page 44 in the PBS Professional Administrator’s Guide](#)), or afterward (see [“Configuring Vnodes” on page 47 in the PBS Professional Administrator’s Guide](#)). Many job attributes can be set at submission via the `qsub` command.

The following are the instructions for setting most attributes.

To set the value of a non-string\_array attribute, use the `qmgr` command, either from the command line or within `qmgr`:

```
qmgr -c "set <object> <attribute> = <value>"  
Qmgr: set <object> <attribute> = <value>
```

To set or change the value of a string\_array attribute, use the `qmgr` command, either from the command line or within `qmgr`:

```
qmgr -c "set <object> <attribute> = <value>"
qmgr -c 'set <object> <attribute> = "<value,value>"'
qmgr -c 'set <object> <attribute> += <value>'
qmgr -c 'set <object> <attribute> -= <value>'
Qmgr: set <object> <attribute> = <value>
Qmgr: set <object> <attribute> = '<value,value>'
Qmgr: set <object> <attribute> += <value>
Qmgr: set <object> <attribute> -= <value>
```

To unset the value of an attribute:

```
qmgr -c "unset <object> <attribute>"
Qmgr: unset <object> <attribute>
```

where *<object>* is one of *server*, *queue*, *hook*, *node*, or *sched*.

For example, to set `resources_max.walltime` at the server to be 24 hours:

```
Qmgr: set server resources_max.walltime = 24:00:00
```

See [“qmgr” on page 157](#).

## 6.3 Viewing Attribute Values

If you want to view attribute values, the following commands are helpful:

`qstat`; see [section 2.57, “qstat”, on page 205](#)

`qmgr`; see [section 2.47, “qmgr”, on page 157](#)

`pbs_rstat`; see [section 2.31, “pbs\\_rstat”, on page 97](#)

- To see server attributes, use one of the following:

`qstat -B -f`  
`Qmgr: list server`

- To see queue attributes, use one of the following:

`qstat -Q -f <queue name>`  
`Qmgr: list queue <queue name>`

- To see job attributes:

`qstat -f <job ID>`

- To see hook attributes:

`Qmgr: list hook <hook name>`

- To see scheduler attributes:

`Qmgr: list sched`

- To see vnode attributes:

`Qmgr: list node <node name>`

- To see reservation attributes:

`pbs_rstat -F`

## 6.4 Attribute Table Format

In the following tables, the columns contain the following information:

**Name**

The name of the attribute

**Description**

A description of the attribute's function

**Format**

The attribute's format

**Val/Opt**

If the attribute can take only specific values or options, each is listed here

Value/Option Description

If the attribute can take only specific values or options, the behavior of each value or option is described here

Default Value, Def Val

The attribute's default value, if any

Python Type

The attribute's Python type

User, Oper, Mgr

Indicates the actions allowed for unprivileged users, Operators, and Managers

The following table shows the operations allowed and their symbols:

Table 6-1: User, Operator, Manager Actions

| Symbol   | Explanation  |
|----------|--|
| <i>r</i> | Entity can read attribute  |
| <i>w</i> | Entity can directly set or alter attribute                           |
| <i>s</i> | Entity can set but not alter attribute                               |
| <i>a</i> | Entity can alter but not set attribute                               |
| <i>i</i> | Entity can indirectly set attribute                                  |
| -        | Entity cannot set or alter attribute, whether directly or indirectly |

6.5 Caveats

- The Python types listed as Python dictionaries support a restricted set of operations. They can reference values by index. Other features, such as `has_key()`, are not available.
- Do not use `qmgr` to set attributes for reservation queues.



## 6.6 Server Attributes

| Server Attributes  |   |              |  |  |             |      |      |      |
|--|---|--------------|--|--|-------------|------|------|------|
| Name<br>Description  | Format  | Val / Opt    | Value/Option Description   | Default Value                                | Python Type | User | Oper | Mgr  |
| <b>acl_host_enable</b><br>Specifies whether the server obeys the host access control list in the <b>acl_hosts</b> server attribute.  | <i>Boolean.</i>   |              | When this attribute is <i>True</i> , the server limits host access according to the access control list.                                   | <i>False</i> ; all hosts allowed access      | bool        | r    | r    | r, w |
| <b>acl_host_moms_enable</b><br>Specifies whether all MoMs are automatically allowed to contact the server with the same privilege as hosts listed in the <b>acl_hosts</b> server attribute.  | <i>Boolean</i>  | <i>True</i>  | All MoMs are automatically allowed to contact the server with the same privilege as hosts listed in the <b>acl_hosts</b> server attribute. | <i>False</i>                                 | bool        | r    | r    | r, w |
|  |   | <i>False</i> | MoMs are not automatically allowed to contact the server with the same privilege as hosts listed in the <b>acl_hosts</b> server attribute. |  |             |      |      |      |
| <b>acl_hosts</b><br>List of hosts from which services can be requested of this server. Requests from the server host are always honored whether or not that host is in the list. This list contains the fully qualified domain names of the hosts. List is evaluated left-to-right; first match in list is used. | <i>String.</i> Syntax: "[+ -]<host-name>.<domain>[, ...]" |              |  | No default                                   | pbs.acl     | r    | r    | r, w |
| <b>acl_resv_group_enable</b><br>Specifies whether the server obeys the group reservation access control list in the <b>acl_resv_groups</b> server attribute.   | <i>Boolean</i>  |              | When this attribute is <i>True</i> , the server limits group access according to the access control list.                                  | <i>False</i> ; all groups allowed access     | bool        | r    | r    | r, w |
| <b>acl_resv_groups</b><br>List of groups allowed or denied permission to create reservations in this PBS complex. The groups in the list are groups on the server host, not submission hosts. List is evaluated left-to-right; first match in list is used.  | <i>String.</i> Syntax: "[+ -]<group name>[, ...]"         |              |  |  | pbs.acl     | r    | r    | r, w |
| <b>acl_resv_host_enable</b><br>Specifies whether the server obeys the host reservation access control list in the <b>acl_resv_hosts</b> server attribute.  | <i>Boolean</i>  |              | When this attribute is <i>True</i> , the server limits host access according to the access control list.                                   | <i>False</i> ; access allowed from all hosts | bool        | r    | r    | r, w |

| Server Attributes  |   |              |  |   |             |      |      |      |
|--|---|--------------|--|---|-------------|------|------|------|
| Name<br>Description  | Format  | Val / Opt    | Value/Option Description   | Default<br>Value  | Python Type | User | Oper | Mgr  |
| <b>acl_resv_hosts</b><br>List of hosts from which reservations can be created in this PBS complex. This list is made up of the fully-qualified domain names of the hosts. List is evaluated left-to-right; first match in list is used.  | <i>String.</i><br>Syntax: "[+ -]<host-name>.<domain>[, ...]"      |              |  | No default  | pbs.acl     | r    | r    | r, w |
| <b>acl_resv_user_enable</b><br>Specifies whether the server limits which users are allowed to create reservations, according to the access control list in the <b>acl_resv_users</b> server attribute.   | <i>Boolean</i>  |              | When this attribute is <i>True</i> , the server limits user reservation creation according to the access control list. | <i>False</i> ; all users are allowed to create reservations | bool        | r    | r    | r, w |
| <b>acl_resv_users</b><br>List of users allowed or denied permission to create reservations in this PBS complex. List is evaluated left-to-right; first match in list is used.  | <i>String.</i><br>Syntax: "[+ -]<user-name>[@<host-name>][, ...]" |              |  | No default  | pbs.acl     | r    | r    | r, w |
| <b>acl_roots</b><br>List of users with root privilege who can submit and run jobs in this PBS complex. For any job whose owner is root or Administrator, the job owner must be listed in this access control list, or the job is rejected. List is evaluated left-to-right; first match in list is used.<br><br>Can be set or altered by root only, and only at the server host. | <i>String.</i><br>Syntax: "[+ -]<user-name>[@<host-name>][, ...]" |              |  | No default; no root jobs allowed                            | pbs.acl     | r    | r    | r    |
| <b>acl_user_enable</b><br>Specifies whether the server limits which users are allowed to run commands at the server, according to the control list in the <b>acl_users</b> server attribute.   | <i>Boolean</i>  |              | When this attribute is <i>True</i> , the server limits user access according to the access control list.               | <i>False</i> ; all users have access                        | bool        | r    | r    | r, w |
| <b>acl_users</b><br>List of users allowed or denied permission to run commands at this server. List is evaluated left-to-right; first match in list is used.   | <i>String.</i><br>Syntax: "[+ -]<user-name>[@<host-name>][, ...]" |              |  | No default  | pbs.acl     | r    | r    | r, w |
| <b>backfill_depth</b><br>Specifies backfilling behavior. Sets the number of jobs that are to be backfilled around. Overridden by <b>backfill_depth</b> queue attribute.<br><br>Recommendation: set this to less than 100.  | <i>Integer.</i><br>Must be $\geq 0$                               | $\geq 0$     | PBS backfills around the specified number of jobs.   | Unset. When unset, backfill depth is 1                      | int         | r    | r, w | r, w |
|  |   | <i>Unset</i> | Backfill depth is set to 1.  |   |             |      |      |      |

| Server Attributes   |   |              |                             |                  |  |      |         |         |
|---|---|--------------|-----------------------------|------------------|--|------|---------|---------|
| Name<br>Description   | Format  | Val / Opt    | Value/Option Description    | Default<br>Value | Python Type  | User | Oper    | Mgr     |
| <b>comment</b><br>Informational text. Can be set by a scheduler or other privileged client.   | <i>String</i> of any form   |              |                             | No default       | str  | r    | r,<br>w | r,<br>w |
| <b>default_chunk</b><br>The list of resources which will be inserted into each chunk of a job's select specification if the corresponding resource is not specified by the user. This provides a means for a site to be sure a given resource is properly accounted for even if not specified by the user.  | <i>String</i> . Syntax:<br><i>default_chunk.&lt;resource name&gt;=&lt;value&gt;,default_chunk.&lt;resource name&gt;=&lt;value&gt;, ...</i>  |              |                             | No default       | pbs.pbs_resource<br>Syntax:<br><i>default_chunk["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r,<br>w | r,<br>w |
| <b>default_node</b><br>No longer used.  |   |              |                             |                  |  | -    | -       | -       |
| <b>default_qdel_arguments</b><br>Argument to <code>qdel</code> command. Automatically added to all <code>qdel</code> commands. See <code>qdel</code> (1B). Overrides standard defaults. Overridden by arguments given on the command line.  | <i>String</i> . Syntax:<br><i>"-Wsuppress_mail=&lt;N&gt;"</i>   |              |                             | No default       | pbs.args   | r    | r,<br>w | r,<br>w |
| <b>default_qsub_arguments</b><br>Arguments that are automatically added to the <code>qsub</code> command. Any valid arguments to <code>qsub</code> command, such as job attributes. Setting a job attribute via <code>default_qsub_arguments</code> sets that attribute for each job which does not explicitly override it. See <code>qsub</code> (1B). Settable by the administrator via the <code>qmgr</code> command. Overrides standard defaults. Overridden by arguments given on the command line and in script directives. | <i>String</i> . Syntax:<br><i>"&lt;option&gt; &lt;value&gt; &lt;option&gt; &lt;value&gt;", e.g. "-r y -N MyJob"</i><br>To add to existing:<br><code>Qmgr: s s default_qsub_arguments += "&lt;option&gt; &lt;value&gt;"</code> |              |                             | No default       | pbs.args   | r    | r,<br>w | r,<br>w |
| <b>default_queue</b><br>The name of the default target queue. Used for requests that do not specify a queue name. Must be set to an existing queue.   | <i>Queue name</i>   |              |                             | <i>workq</i>     | pbs.queue  | r    | r,<br>w | r,<br>w |
| <b>eligible_time_enable</b><br>Enables accruing job wait time in the job's <code>eligible_time</code> attribute.  | <i>Boolean</i>  | <i>True</i>  | Job can accrue wait time    | <i>False</i>     | bool   | r    | r       | r,<br>w |
|   |   | <i>False</i> | Job cannot accrue wait time |                  |  |      |         |         |

| Server Attributes  |                 |              |  |  |              |      |      |      |
|--|-----------------|--------------|--|--|--------------|------|------|------|
| Name<br>Description  | Format          | Val / Opt    | Value/Option Description   | Default<br>Value                         | Python Type  | User | Oper | Mgr  |
| elim_on_subjobs<br>Specifies whether the server <code>max_queued</code> limit attribute counts each array job as a single job, or counts each subjob as a single job.  | <i>Boolean</i>  | <i>False</i> | The <code>max_queued</code> limit counts each array job as a single job.   | <i>True</i>                              | bool         | r    | r    | r, w |
|  |                 | <i>True</i>  | The <code>max_queued</code> limit counts each subjob as a single job.  |  |              |      |      |      |
| est_start_time_freq<br><b>Obsolete.</b> No longer used.  |                 |              |  |  |              |      |      |      |
| flatuid<br>Used for authorization allowing users to submit and alter jobs. Specifies whether user names are treated as being the same across the PBS server and all submission hosts in the PBS complex. Can be used to allow users without accounts at the server host to submit jobs.<br>If UserA has an account at the server host, PBS requires that <code>UserA@&lt;server host&gt;</code> is the same as <code>UserA@&lt;execution host&gt;</code> . | <i>Boolean</i>  | <i>True</i>  | PBS assumes that <code>UserA@&lt;submithost&gt;</code> is same user as <code>UserA@&lt;server name&gt;</code> . Jobs that run under the name of the job owner do not need authorization.<br>A job submitted under a different username, by using the <code>u</code> option to the <code>qsub</code> command, requires authorization.<br>Entries in <code>.rhosts</code> or <code>hosts.equiv</code> are not checked, so even if <code>UserA@host1</code> has an entry for <code>UserB@host2</code> , <code>UserB@host2</code> cannot operate on <code>UserA@host1</code> 's jobs.<br>User without account on server can submit jobs. | <i>False</i> ; authorization is required | bool         | r    | r    | r, w |
|  |                 | <i>False</i> | PBS does not assume that <code>UserA@&lt;submission host&gt;</code> is the same user as <code>UserA@&lt;server host&gt;</code> . Jobs that run under the name of the job owner need authorization.<br>Users must have accounts on the server host to submit jobs.  |  |              |      |      |      |
| FLicenses<br><b>Obsolete.</b> No longer used.  |                 |              |  |  |              |      |      |      |
| job_history_duration<br>The length of time PBS will keep each job's history.   | <i>Duration</i> |              |  | <i>Two weeks</i>                         | pbs.duration | r    | r    | r, w |

| Server Attributes  |   |                           |   |   |                      |      |         |         |
|--|---|---------------------------|---|---|----------------------|------|---------|---------|
| Name<br>Description  | Format  | Val / Opt                 | Value/Option Description  | Default<br>Value  | Python Type          | User | Oper    | Mgr     |
| <b>job_history_enable</b><br>Enables job history management. Setting this attribute to <i>True</i> enables job history management.   | <i>Boolean</i>  |                           |   | <i>False</i>  | bool                 | r    | r       | r,<br>w |
| <b>job_requeue_timeout</b><br>The amount of time that can be taken while requeuing a job.<br>Minimum allowed value: 1 second. Maximum allowed value: 3 hours.  | Duration  |                           |   | <i>45 seconds</i>   | pbs.duration         | r    | r,<br>w | r,<br>w |
| <b>job_sort_formula</b><br>Formula for computing job priorities. Described in the <i>PBS Professional Administrator's Guide</i> . If the attribute <code>job_sort_formula</code> is set, all schedulers use the formula in it to compute job priorities. When this scheduler sorts jobs according to the formula, it computes a priority for each job, where that priority is the value produced by the formula. Jobs with a higher value get higher priority. | <i>String</i> . Syntax: mathematical formula; can be made up of expressions, where expressions contain terms which are added, subtracted, multiplied, or divided, and which can contain parentheses, exponents, unary plus and minus, the ternary operator, and Python math module functions. |                           |   | Unset   | pbs.job_sort_formula | r    | r       | r,<br>w |
| <b>jobscript_max_size</b><br>Limit on the size of any job script.  | <i>size</i><br>Units default to bytes   |                           |   | <i>100MB</i>  | pbs.size             | r    | r       | r,<br>w |
| <b>license_count</b><br>The <code>license_count</code> attribute contains the following elements with their values: <code>Avail_Global</code> , <code>Avail_Local</code> , <code>Used</code> , <code>High_Use</code> .   | <i>String</i> .<br>Syntax:<br><i>Avail_Global</i> :<value><br><i>Avail_Local</i> :<value><br><i>Used</i> :<value><br><i>High_Use</i> :<value>   | <code>Avail_Global</code> | The number of licenses available at ALM license server (checked in.)                                | <i>Avail_Global</i> :0<br><i>Avail_Local</i> :0<br><i>Used</i> :0<br><i>High_Use</i> :0 | pbs.license_count    | r    | r       | r       |
|  |   | <code>Avail_Local</code>  | The number of licenses kept by PBS (checked out.)   |   |                      |      |         |         |
|  |   | <code>Used</code>         | The number of licenses currently in use.  |   |                      |      |         |         |
|  |   | <code>High_Use</code>     | The highest number of licenses ever checked out and used by the current instance of the PBS server. |   |                      |      |         |         |
| <b>log_events</b><br>The types of events the server logs.  | <i>Integer</i> representation of bit string   |                           |   | <i>511</i>  | int                  | r    | r,<br>w | r,<br>w |

| Server Attributes   |   |   |                          |                                |  |      |      |      |
|---|---|---|--------------------------|--------------------------------|--|------|------|------|
| Name<br>Description   | Format  | Val / Opt                                     | Value/Option Description | Default Value                  | Python Type  | User | Oper | Mgr  |
| <b>mailer</b><br>Path to mailer to be used by PBS. This mailer should function similarly to <code>sendmail</code> .   | <i>String</i>   |   |                          | <i>SENDMAIL_CMD macro</i>      | str  | r    | r    | r, w |
| <b>mail_from</b><br>The username from which server-generated mail is sent to users. Mail is sent <b>to</b> this address upon failover.  | <i>String</i>   |   |                          | <i>"adm"</i>                   | str  | r    | r    | r, w |
| <b>managers</b><br>List of PBS Managers.  | <i>String</i> . Syntax: " <i>&lt;user-name&gt;@&lt;host-name&gt;.&lt;subdomain&gt;.&lt;domain&gt;[,&lt;user-name&gt;@&lt;host-name&gt;.&lt;subdomain&gt;.&lt;domain&gt;...]</i> ". The host, sub-domain, or domain name may be wildcarded with an asterisk (*). |   |                          | <i>Root on the server host</i> | pbs.acl  | r    | r    | r, w |
| <b>max_array_size</b><br>The maximum number of subjobs allowed in any array job.  | <i>Integer</i>  |   |                          | <i>10000</i>                   | int  | r    | r, w | r, w |
| <b>max_concurrent_provision</b><br>The <code>max_concurrent_provision</code> attribute is the number of vnodes allowed to be in the process of being provisioned. Cannot be set to zero. When unset, default value is used. | <i>Integer</i>  | >0  |                          | 5                              | int  | r    | r    | r, w |
| <b>max_group_res</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum amount of the specified resource that any single group may consume in this PBS complex.                                    | <i>String</i> . Syntax: <i>max_group_res.&lt;resource name&gt;=&lt;value&gt;</i>  | Any PBS resource, e.g. "ncpus", "mem", "pmem" |                          | No default                     | pbs.pbs_resource<br>Syntax:<br><i>max_group_res["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |

| Server Attributes  |   |   |                          |                  |   |      |          |      |
|--|---|---|--------------------------|------------------|---|------|----------|------|
| Name<br>Description  | Format  | Val / Opt   | Value/Option Description | Default<br>Value | Python Type   | User | Operator | Mgr  |
| <b>max_group_res_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit for the specified resource that any single group may consume in this complex. If a group is consuming more than this amount of the specified resource, their jobs are eligible to be preempted by jobs from groups who are not over their soft limit. | <i>String</i> . Syntax:<br><i>max_group_res_soft.</i><br><i>&lt;resource name&gt;=&lt;value&gt;</i> | Any PBS resource, e.g. "ncpus", "mem", "pmem", etc. |                          | None             | pbs.pbs_resource<br><br>Syntax:<br><i>max_group_res_soft["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w     | r, w |
| <b>max_group_run</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by the users in one group allowed to be running within this complex at one time.   | <i>Integer</i>  |   |                          | No default       | int   | r    | r, w     | r, w |
| <b>max_group_run_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by the users in one group allowed to be running in this complex at one time. If a group has more than this number of jobs running, their jobs are eligible to be preempted by jobs from groups who are not over their soft limit.   | <i>Integer</i>  |   |                          | No default       | int   | r    | r, w     | r, w |
| <b>max_job_sequence_id</b><br>Maximum value of sequence number in a job ID, job array ID, or reservation ID.<br>Minimum allowed is 9999999. Maximum allowed is 999999999999.<br>After specified maximum for sequence number has been reached, job IDs start again at 0.  | <i>Integer</i>  |   |                          | 9999999          | int   | r    | r        | r, w |

| Server Attributes  |  |           |                          |                  |   |      |      |      |
|--|--|-----------|--------------------------|------------------|---|------|------|------|
| Name<br>Description  | Format   | Val / Opt | Value/Option Description | Default<br>Value | Python Type   | User | Oper | Mgr  |
| <b>max_queued</b><br>Limit attribute. The maximum number of jobs allowed to be queued or running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.<br>The effect of this limit depends on how the <code>elim_on_subjobs</code> attribute is set; when <code>elim_on_subjobs</code> is <i>True</i> (the default), <code>max_queued</code> counts each subjob as a job; when <code>elim_on_subjobs</code> is <i>False</i> , <code>max_queued</code> counts each array job as a single job. | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .   |           |                          | No default       | str   | r    | r, w | r, w |
| <b>max_queued_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs queued or running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .<br>Syntax:<br><i>max_queued_res.&lt;resource name&gt; = "&lt;limit&gt;"</i> |           |                          | No default       | pbs.pbs_resource<br>Syntax:<br><i>max_queued_res["&lt;resource name&gt;"] = &lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |
| <b>max_run</b><br>Limit attribute. The maximum number of jobs allowed to be running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .   |           |                          | No default       | str   | r    | r, w | r, w |
| <b>max_run_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .<br>Syntax:<br><i>max_run_res.&lt;resource name&gt; = "&lt;limit&gt;"</i>    |           |                          | No default       | pbs.pbs_resource<br>Syntax:<br><i>max_run_res["&lt;resource name&gt;"] = &lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource    | r    | r, w | r, w |



| Server Attributes   |  |  |                          |                  |   |      |             |
|---|--|--|--------------------------|------------------|---|------|-------------|
| Name<br>Description   | Format   | Val / Opt  | Value/Option Description | Default<br>Value | Python Type   | User | Oper<br>Mgr |
| <b>max_run_res_soft</b><br>Limit attribute. Soft limit on the amount of the specified resource allowed to be allocated to jobs running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .<br><i>max_run_res_soft.&lt;resource name&gt; = "&lt;.limit&gt;"</i> |  |                          | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><i>max_run_res_soft["&lt;resource name&gt;"] = &lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource  | r    | r, w        |
| <b>max_run_soft</b><br>Limit attribute. Soft limit on the number of jobs allowed to be running in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .   |  |                          | No default       | <code>str</code>  | r    | r, w        |
| <b>max_running</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs in this complex allowed to be running at any given time.  | <i>Integer</i>   |  |                          | No default       | <code>int</code>  | r    | r, w        |
| <b>max_user_res</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum amount of the specified resource that any single user may consume within this complex.  | <i>String</i> . Syntax:<br><i>max_user_res.&lt;resource name&gt; = &lt;value&gt;</i>   | Any PBS resource, e.g. "ncpus", "mem", "pmem", etc.      |                          | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><i>max_user_res["&lt;resource name&gt;"] = &lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource      | r    | r, w        |
| <b>max_user_res_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit on the amount of the specified resource that any single user may consume within this complex. If a user is consuming more than this amount of the specified resource, their jobs are eligible to be preempted by jobs from users who are not over their soft limit. | <i>String</i> . Syntax:<br><i>max_user_res_soft.&lt;resource name&gt; = &lt;value&gt;</i>  | Any valid PBS resource, e.g. "ncpus", "mem", "pmem", etc |                          | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><i>max_user_res_soft["&lt;resource name&gt;"] = &lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w        |

| Server Attributes   |  |              |  |                  |                    |      |         |         |
|---|--|--------------|--|------------------|--------------------|------|---------|---------|
| Name<br>Description   | Format   | Val / Opt    | Value/Option Description   | Default<br>Value | Python Type        | User | Oper    | Mgr     |
| <b>max_user_run</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by a single user allowed to be running within this complex at one time.  | <i>Integer</i>   |              |  | No default       | int                | r    | r,<br>w | r,<br>w |
| <b>max_user_run_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit on the number of jobs owned by a single user that are allowed to be running within this complex at one time. If a user has more than this number of jobs running, their jobs are eligible to be preempted by jobs from users who are not over their soft limit. | <i>Integer</i>   |              |  | No default       | int                | r    | r,<br>w | r,<br>w |
| <b>node_fail_requeue</b><br>Controls whether running jobs are automatically requeued or are deleted when the primary execution host fails. Number of seconds to wait after losing contact with Mother Superior before requeueing or deleting jobs.<br>Reverts to default value when server is restarted.  | <i>Integer.</i><br>Units: <i>Seconds.</i>  | <i>&lt;0</i> | Behaves as if set to <i>1</i> .  | <i>310</i>       | int                | r    | r,<br>w | r,<br>w |
|   |  | <i>0</i>     | Jobs are not requeued; they are left in the <i>Running</i> state until the execution host is recovered.                              |                  |                    |      |         |         |
|   |  | <i>&gt;0</i> | When the host has been down for the specified number of seconds, jobs are requeued if they are marked as rerunnable, or are deleted. |                  |                    |      |         |         |
|   |  | Unset        | Behaves as if set to default value of <i>310</i> .   |                  |                    |      |         |         |
| <b>node_group_enable</b><br>Specifies whether placement sets (which includes node grouping) are enabled. See <b>node_group_key</b> server attribute.  | <i>Boolean</i>   |              | When set to <i>True</i> , placement sets are enabled.  | <i>False</i>     | bool               | r    | r,<br>w | r,<br>w |
| <b>node_group_key</b><br>Specifies the resources to use for placement sets (node grouping). Overridden by queue's <b>node_group_key</b> attribute. See <b>node_group_enable</b> server attribute.   | <i>String_array</i><br>When specifying multiple resources, separate them with commas and enclose the value in double quotes. |              |  | Unset            | pbs.node_group_key | r    | r,<br>w | r,<br>w |

| Server Attributes   |  |           |                          |                               |              |      |      |      |
|---|--|-----------|--------------------------|-------------------------------|--------------|------|------|------|
| Name<br>Description   | Format   | Val / Opt | Value/Option Description | Default<br>Value              | Python Type  | User | Oper | Mgr  |
| operators<br>List of PBS Operators.   | <i>String</i> . Syntax:<br><user-name>@<host-name>.<subdomain>.<domain name>[, <user-name>@<host-name>.<subdomain>.<domain name> ...]. The host, subdomain, or domain name may be wildcarded with an asterisk (*).   |           |                          | No default                    | pbs.acl      | r    | r    | r, w |
| pbs_license_file_location<br><b>Deprecated.</b> Do not use.   | -  | -         | -                        | -                             | -            | -    | -    | -    |
| pbs_license_info<br>Location of license server(s).  | <i>String</i> . Syntax:<br>One or more port number and host-name combinations:<br><port1>@<host1>[:<port2>@<host2>:...:<portN>@<hostN>] where <i>host1</i> , <i>host2</i> , ... <i>hostN</i> can be IP addresses.<br>Delimiter between items is colon (":"). |           |                          | No default                    | str          | r    | r    | r, w |
| pbs_license_linger_time<br>The number of seconds to keep an unused license, when the number of licenses is above the value given by pbs_license_min.  | <i>Integer</i> .<br>Units: seconds.  |           |                          | 31536000<br>seconds (1 year). | pbs.duration | r    | r    | r, w |
| pbs_license_max<br>Maximum number of licenses to be checked out at any time, i.e maximum number of 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. | <i>Integer</i>   |           |                          | Maximum value for an integer  | int          | r    | r    | r, w |

| Server Attributes   |   |           |   |                  |              |      |      |         |
|---|---|-----------|---|------------------|--------------|------|------|---------|
| Name<br>Description   | Format  | Val / Opt | Value/Option Description                                    | Default<br>Value | Python Type  | User | Oper | Mgr     |
| pbs_license_min<br>Minimum number of nodes or sockets to permanently keep licensed, i.e. the minimum number of licenses to keep in the PBS local license pool. This is the minimum number of licenses to keep checked out.<br>If unset, PBS automatically sets the value to 0.  | Integer   |           |   | 0                | int          | r    | r    | r,<br>w |
| pbs_version<br>The version of PBS for this server.  | String  |           |   | No default       | pbs.version  | r    | r    | r       |
| power_provisioning<br>Reflects use of power profiles via PBS. Set by PBS to <i>True</i> when PBS_power hook is enabled.   | Boolean   | True      | Power provisioning is enabled.                              | False            | bool         | r    | r    | r,<br>w |
|   |   | False     | Power provisioning is disabled.                             |                  |              |      |      |         |
| python_gc_min_interval<br>Specifies interval for Python garbage collection. For no garbage collection, set this to zero.  | Integer<br>Units: <i>Seconds</i><br>or<br>[[HH:]MM:]SS<br>(duration)  | 0         | No garbage collection takes place.                          | 30               | int          | r    | r    | r,<br>w |
|   |   | >0        | Garbage collection takes place with the specified interval. |                  |              |      |      |         |
| python_restart_max_hooks<br>The maximum number of hooks to be serviced before the Python interpreter is restarted. If this number is exceeded, and the time limit set in python_restart_min_interval has elapsed, the Python interpreter is restarted.  | Integer   |           |   | 100              | int          | r    | r    | r,<br>w |
| python_restart_max_objects<br>The maximum number of objects to be created before the Python interpreter is restarted. If this number is exceeded, and the time limit set in python_restart_min_interval has elapsed, the Python interpreter is restarted.   | Integer   |           |   | 1000             | int          | r    | r    | r,<br>w |
| python_restart_min_interval<br>The minimum time interval before the Python interpreter is restarted. If this interval has elapsed, and either the maximum number of hooks to be serviced (set in python_restart_max_hooks) has been exceeded or the maximum number of objects to be created (set in python_restart_max_objects) has been exceeded, the Python interpreter is restarted. | Integer.<br>Units: <i>Seconds</i><br>or<br>[[HH:]MM:]SS<br>(duration) |           |   | 30               | pbs.duration | r    | r    | r,<br>w |

| Server Attributes   |  |           |  |   |  |      |         |         |
|---|--|-----------|--|---|--|------|---------|---------|
| Name<br>Description   | Format   | Val / Opt | Value/Option Description   | Default<br>Value  | Python Type  | User | Oper    | Mgr     |
| <b>query_other_jobs</b><br>Controls whether unprivileged users are allowed to select or query the status of jobs owned by other users.  | <i>Boolean</i>   |           | When this attribute is <i>True</i> , unprivileged users can query or select other users' jobs. | On installation: <i>True</i><br>After being unset: <i>False</i> | bool   | r    | r       | r,<br>w |
| <b>queued_jobs_threshold</b><br>Limit attribute. The maximum number of jobs allowed to be queued in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification.<br>See <a href="#">Chapter 7, "Formats", on page 357</a> .  |           |  | No default  | str  | r    | r,<br>w | r,<br>w |
| <b>queued_jobs_threshold_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs queued in the complex. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.  | Limit specification.<br>See <a href="#">Chapter 7, "Formats", on page 357</a> .<br><i>queued_jobs_threshold_res.&lt;resource name&gt; = "&lt;.limit&gt;"</i> |           |  | No default  | pbs.pbs_resource<br>Syntax:<br><i>queued_jobs_threshold_res["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r,<br>w | r,<br>w |
| <b>reserve_retry_cutoff</b><br><b>Obsolete.</b> No longer used.   |  |           |  |   |  |      |         |         |
| <b>reserve_retry_init</b><br><b>Deprecated.</b> The amount of time after a reservation becomes degraded that PBS waits before attempting to reconfirm the reservation. When this value is changed, only reservations that become degraded after the change use the new value. Must be greater than zero.                                      | <i>Integer.</i><br>Units: <i>Seconds</i>   |           |  | 7200 (2 hours)  | int  | -    | -       | r,<br>w |
| <b>reserve_retry_time</b><br>The amount of time after a reservation becomes degraded that PBS waits before attempting to reconfirm the reservation, as well as amount of time between attempts to reconfirm degraded reservations. When this value is changed, PBS uses the new value for any subsequent attempts. Must be greater than zero. | <i>Integer.</i><br>Units: <i>Seconds</i>   |           |  | 600 (10 minutes)  | int  | r    | r       | r,<br>w |

| Server Attributes  |  |           |                          |                  |  |      |             |
|--|--|-----------|--------------------------|------------------|--|------|-------------|
| Name<br>Description  | Format   | Val / Opt | Value/Option Description | Default<br>Value | Python Type  | User | Oper<br>Mgr |
| <b>resources_assigned</b><br>The total of each type of resource allocated to jobs running and exiting in this complex, plus the total of each type of resource allocated to any reservation. Reservation resources are added when the reservation starts.  | <i>String</i> . Syntax:<br><i>resources_assigned.</i><br><i>&lt;resource name&gt;=&lt;value&gt;[,resources_assigned.&lt;resource name&gt;=&lt;value&gt;,...]</i> |           |                          | No default       | pbs.pbs_resource<br>Syntax:<br><i>resources_assigned["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource  | r    | r           |
| <b>resources_available</b><br>The list of available resources and their values defined on the server. Each resource is listed on a separate line.  | <i>String</i> . Syntax:<br><i>resources_available.</i><br><i>&lt;resource name&gt;=&lt;value&gt;</i>   |           |                          | No default       | pbs.pbs_resource<br>Syntax:<br><i>resources_available["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w        |
| <b>resources_cost</b><br>No longer used.   |  |           |                          |                  |  | -    | -           |
| <b>resources_default</b><br>The list of default job-wide resource values that are set as limits for jobs in this complex when a) the job does not specify a limit, and b) there is no queue default.<br>The value for a string array, e.g. <i>resources_default.&lt;string array resource&gt;</i> , can contain only one string.<br>For host-level resources, see the <i>default_chunk.&lt;resource name&gt;</i> server attribute. | <i>String</i><br>Syntax:<br><i>resources_default.&lt;resource name&gt;=&lt;value&gt;[,...]</i>   |           |                          | No limit         | pbs.pbs_resource<br>Syntax:<br><i>resources_default["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource   | r    | r, w        |

| Server Attributes   |   |                               |   |                           |  |      |          |      |
|---|---|-------------------------------|---|---------------------------|--|------|----------|------|
| Name<br>Description   | Format  | Val / Opt                     | Value/Option Description  | Default<br>Value          | Python Type  | User | Operator | Mgr  |
| <b>resources_max</b><br>The maximum amount of each resource that can be requested by any single job in this complex, if there is not a <b>resources_max</b> value defined for the queue at which the job is targeted. This attribute functions as a gating value for jobs entering the PBS complex. | <i>String</i><br>Syntax:<br><i>resources_max.&lt;resource name&gt;=&lt;value&gt;[, ...]</i> |                               |   | No limit                  | pbs.pbs_resource<br>Syntax:<br><i>resources_max["&lt;resource name&gt;"]=&lt;value&gt;</i> where <i>resource name</i> is any built-in or custom resource | r    | r, w     | r, w |
| <b>restrict_res_to_release_on_suspend</b><br>Comma-separated list of consumable resources to be released when jobs are suspended. If unset, all consumable resources are released on suspension.  | <i>String_array</i><br>Syntax: comma-separated list   |                               |   | unset                     | Python list  | r    | r        | r, w |
| <b>resv_enable</b><br>Specifies whether or not advance and standing reservations can be created in this complex.  | <i>Boolean</i>  |                               | When set to <i>True</i> , new reservations can be created. When changed from <i>True</i> to <i>False</i> , new reservations cannot be created, but existing reservations are honored. | <i>True</i>               | bool   | r    | r        | r, w |
| <b>resv_post_processing_time</b><br>The amount of time allowed for reservations to clean up after running jobs.<br>Reservation duration and end time are extended by this amount of time. Jobs are not allowed to run during the cleanup period.  | <i>Duration</i>   |                               |   | Unset; behaves as if zero | int  | r    | r, w     | r, w |
| <b>rpp_highwater</b><br>The maximum number of messages.   | <i>Integer</i>  | Greater than or equal to one  |   | 1024                      | int  | r    | r        | r, w |
| <b>rpp_max_pkt_check</b><br>Maximum number of TPP messages processed by the main server thread per iteration.   | Integer   |                               |   | 64                        | int  | r    | r        | r, w |
| <b>rpp_retry</b><br>In a fault-tolerant setup (multiple <b>pbs_comms</b> ), when the first <b>pbs_comm</b> fails partway through a message, this is number of times TPP tries to use the first <b>pbs_comm</b> .  | <i>Integer</i>  | Greater than or equal to zero |   | 10                        | int  | r    | r        | r, w |

| Server Attributes   |  |           |  |  |              |      |         |         |
|---|--|-----------|--|--|--------------|------|---------|---------|
| Name<br>Description   | Format   | Val / Opt | Value/Option Description   | Default<br>Value   | Python Type  | User | Oper    | Mgr     |
| <b>scheduler_iteration</b><br>The time between scheduling iterations.   | <i>Integer.</i><br>Units: <i>Seconds.</i>  |           |  | <i>10 minutes</i><br>( <i>600 seconds</i> )              | pbs.duration | r    | r,<br>w | r,<br>w |
| <b>scheduling</b><br>Enables scheduling of jobs. Specified by value of <b>-a</b> option to <b>pbs_server</b> command. If <b>-a</b> is not specified, value is taken from previous invocation of <b>pbs_server</b> .   | <i>Boolean</i>   |           | When this attribute is set to <i>True</i> , scheduling is enabled. | <i>False</i> if never set via <b>pbs_server</b> command. | bool         | r    | r,<br>w | r,<br>w |
| <b>server_host</b><br>The name of the host on which the active server is running.<br>If the secondary server takes over, this attribute is set to the name of the secondary server's host. When the primary server takes control again, this attribute shows the name of the primary server's host. | <i>String.</i> Syntax:<br><host-name>.<domain name><br>If the server is listening to a non-standard port, the port number is appended, with a colon, to the host-name: <host-name>.<domain name>:<port number> |           |  | No default   | str          | r    | r       | r       |



| Server Attributes   |   |                            |  |                  |  |      |      |     |
|---|---|----------------------------|--|------------------|--|------|------|-----|
| Name<br>Description   | Format  | Val / Opt                  | Value/Option Description   | Default<br>Value | Python Type  | User | Oper | Mgr |
| server_state<br>The current state of the server:  | <i>String</i>   | <i>Active</i>              | The server is running. The scheduler is not in a scheduling cycle.   | No default       | Server state constant<br>pbs.SV_STATE_ACTIVE                             | r    | r    | r   |
|   |   | <i>Hot_Start</i>           | The server will run first any jobs that were running when it was shut down.  |                  | Server state constant<br>pbs.SV_STATE_HOT                                |      |      |     |
|   |   | <i>Idle</i>                | The server is running. The default scheduler's scheduling attribute is <i>False</i> .                                      |                  | Server state constant<br>pbs.SV_STATE_IDLE                               |      |      |     |
|   |   | <i>Scheduling</i>          | The server is running. The scheduler is in a scheduling cycle.   |                  | Server state constant<br>pbs.SV_STATE_ACTIVE                             |      |      |     |
|   |   | <i>Terminating</i>         | The server is terminating. No additional jobs will be run.   |                  | Server state constant<br>pbs.SV_STATE_SHUTIMM or<br>pbs.SV_STATE_SHUTSIG |      |      |     |
|   |   | <i>Terminating_Delayed</i> | Server is terminating in delayed mode. No new jobs will be run. server will shut down after all running jobs are finished. |                  | Server state constant<br>pbs.SV_STATE_SHUTDEL                            |      |      |     |
| single_signon_password_enable<br><b>Removed.</b> (2020.1)   |   |                            |  |                  |  |      |      |     |
| state_count<br>List of the number of jobs in each state in the complex. Suspended jobs are counted as running.  | <i>String</i> . Syntax:<br><i>transiting=&lt;value&gt;</i> ,<br><i>queued=&lt;value&gt;</i> , ... |                            |  | No default       | pbs.state_count  | r    | r    | r   |
| system_cost<br>No longer used.  |   |                            |  |                  |  | -    | -    | -   |
| total_jobs<br>The total number of jobs in the complex. If the <i>job_history_enable</i> attribute is set to <i>True</i> , this includes jobs that are finished, deleted, and moved. | <i>Integer</i>  |                            |  | No default       | int  | r    | r    | r   |

| Server Attributes   |   |           |   |                  |             |      |      |      |
|---|---|-----------|---|------------------|-------------|------|------|------|
| Name<br>Description   | Format  | Val / Opt | Value/Option Description                                    | Default<br>Value | Python Type | User | Oper | Mgr  |
| <b>webapi_auth_issuers</b><br>Comma-separated list of accepted JWT token issuers. Used only when using JWT tokens generated via <code>hpcgentoken</code> .  | <i>String array</i><br>Syntax: comma-separated list |           | List of OIDC token issuers to be accepted by the PBS server | None             | str         | r    | r    | r, w |
| <b>webapi_enable</b><br>Enables or disables web API support in PBS  | <i>Boolean</i>                                      | <i>0</i>  | Disables web API support                                    | <i>False</i>     | bool        | r    | r    | r, w |
|   |   | <i>1</i>  | Enables web API support                                     |                  |             |      |      |      |
| <b>webapi_oidc_clientid</b><br>Used with external OIDC service. The client identifier generated when registering the application with the OIDC provider. For validation of OIDC ID tokens passed in http(s) requests. | <i>String</i>                                       |           |   | None             | str         | r    | r    | r, w |
| <b>webapi_oidc_provider_url</b><br>Used with external OIDC service. URL of the OIDC provider, for example <code>https://accounts.google.com</code> . For validation of OIDC ID tokens passed in http(s) requests.     | <i>String</i>                                       |           |   | None             | str         | r    | r    | r, w |

## 6.7 Scheduler Attributes

| Scheduler Attributes   |                |              |  |                  |                    |                     |
|--|----------------|--------------|--|------------------|--------------------|---------------------|
| Name<br>Description  | Format         | Val / Opt    | Value/Option Description   | Default<br>Value | Pyth<br>on<br>Type | User<br>Oper<br>Mgr |
| <b>comment</b><br>For certain scheduler errors, PBS sets the scheduler's <b>comment</b> attribute to specific error messages. You can use the <b>comment</b> attribute to notify another administrator of something, but PBS does overwrite the value of <b>comment</b> under certain circumstances. | <i>String</i>  |              |  | No default       | None               | r r r, w            |
| <b>do_not_span_psets</b><br>Specifies whether or not this scheduler requires the job to fit within one existing placement set.   | <i>Boolean</i> | <i>True</i>  | The job must fit in one existing placement set. All existing placement sets are checked. If the job fits in an occupied placement set, the job waits for the placement set to be available. If the job can't fit within a single placement set, it won't run.  | <i>False</i>     | None               | r r, w r, w         |
|  |                | <i>False</i> | This scheduler first attempts to place the job in a single placement set. All existing placement sets are checked. If the job fits in an occupied placement set, the job waits for the placement set to be available. If there is no existing placement set, occupied or empty, into which the job could fit, the job runs regardless of placement sets, running on whichever vnodes can satisfy the job's resource request. |                  |                    |                     |

| Scheduler Attributes   |  |                     |   |  |                    |          |             |             |
|--|--|---------------------|---|--|--------------------|----------|-------------|-------------|
| Name<br>Description  | Format   | Val / Opt           | Value/Option Description  | Default<br>Value                         | Pyth<br>on<br>Type | User     | Oper        | Mgr         |
| <b>job_run_wait</b><br>Controls how long the PBS server waits after sending a job for execution before sending another job.<br>The <b>job_run_wait</b> scheduler attribute replaces the <b>throughput_mode</b> scheduler attribute. We recommend using <b>job_run_wait</b> , and we recommend not setting or using <b>throughput_mode</b> .<br>If you set <b>job_run_wait</b> to <i>none</i> or <i>runjob_hook</i> , PBS changes <b>throughput_mode</b> to <i>True</i> .<br>If you set <b>job_run_wait</b> to <i>execjob_hook</i> , PBS changes <b>throughput_mode</b> to <i>False</i> .<br>If you set <b>throughput_mode</b> to <i>True</i> , PBS changes <b>job_run_wait</b> to <i>runjob_hook</i> .<br>If you set <b>throughput_mode</b> to <i>False</i> , PBS changes <b>job_run_wait</b> to <i>execjob_hook</i> . | <i>String</i>                                  | <i>none</i>         | The PBS server runs the next job immediately.   | <i>runjob_hook</i>                       | <i>str</i>         | <i>r</i> | <i>r</i>    | <i>r, w</i> |
|  |  | <i>runjob_hook</i>  | The PBS server waits until any <b>runjob</b> hooks have run, then runs the next job.    |  |                    |          |             |             |
|  |  | <i>execjob_hook</i> | The PBS server waits until any <b>execjob_*</b> hooks have run, then runs the next job. |  |                    |          |             |             |
| <b>job_sort_formula_threshold</b><br>Lower bound for calculated priority for job. If job priority is at or below this value, the job is not eligible to run in the current scheduler cycle.  | <i>Float</i>                                   |                     |   | No default                               | None               | -        | <i>r</i>    | <i>r, w</i> |
| <b>log_events</b><br>Types of events logged by this scheduler.   | <i>Integer</i><br>representation of bit string |                     |   | 767                                      | None               | <i>r</i> | <i>r, w</i> | <i>r, w</i> |
| <b>only_explicit_psets</b><br>Specifies whether placement sets are created for unset resources.  | <i>Boolean</i>                                 | <i>True</i>         | Placement sets are not created from vnodes whose value for a resource is unset.         | <i>False</i>                             | None               | <i>r</i> | <i>r, w</i> | <i>r, w</i> |
|  |  | <i>False</i>        | Placement sets are created from vnodes whose value for a resource is unset.             |  |                    |          |             |             |
| <b>opt_backfill_fuzzy</b><br>Sets the trade-off between scheduling cycle speed and granularity of estimated start time calculation.  | <i>String</i>                                  | <i>off</i>          | Finest granularity, no speedup  | <i>unset;</i><br>behaves like <i>low</i> | None               | <i>r</i> | <i>r</i>    | <i>r, w</i> |
|  |  | <i>low</i>          | Fairly fine granularity, some speedup   |  |                    |          |             |             |
|  |  | <i>medium</i>       | Medium granularity, medium speedup  |  |                    |          |             |             |
|  |  | <i>high</i>         | Coarse granularity, greatest speedup  |  |                    |          |             |             |
| <b>partition</b><br>Name of partition for which this scheduler is to run jobs. Cannot be set on default scheduler.   | <i>String</i>                                  |                     |   | "None"                                   | None               | <i>r</i> | <i>r</i>    | <i>r, w</i> |

| Scheduler Attributes   |                                     |                          |   |                              |                    |      |      |      |
|--|-------------------------------------|--------------------------|---|------------------------------|--------------------|------|------|------|
| Name<br>Description  | Format                              | Val / Opt                | Value/Option Description  | Default<br>Value             | Pyth<br>on<br>Type | User | Oper | Mgr  |
| <b>pbs_version</b><br>The version of PBS for this scheduler.   | <i>String</i>                       |                          |   | No default                   | None               | -    | r    | r    |
| <b>preempt_order</b><br>Defines the order of preemption methods which this scheduler uses on jobs. This order can change depending on the percentage of time remaining on the job. The ordering can be any combination of <i>S</i> , <i>C</i> , <i>R</i> , and <i>D</i> .<br>Usage: an ordering ( <i>SCR</i> ) optionally followed by a percentage of time remaining and another ordering.<br>For example, PBS should first attempt to use suspension to preempt a job, and if that is unsuccessful, requeue the job:<br>preempt_order: "SR"<br>For example, if the job has between 100% and 81% of requested time remaining, first try to suspend the job, then try checkpoint, then requeue. If the job has between 80% and 51% of requested time remaining, attempt suspend, then checkpoint. Between 50% and 0% time remaining, just attempt to suspend the job:<br>preempt_order: "SCR 80 SC 50 S"<br>For each job percentage, each method can be used only once. Note that in the example above, the <i>S</i> method appears only once per percentage. | <i>String, as a quoted list</i>     | <i>C</i>                 | Checkpoint job  | "SCR"                        |                    | r    | r    | r, w |
|  |                                     | <i>D</i>                 | Delete job  |                              |                    |      |      |      |
|  |                                     | <i>R</i>                 | Requeue job   |                              |                    |      |      |      |
|  |                                     | <i>S</i>                 | Suspend job   |                              |                    |      |      |      |
| <b>preempt_prio</b><br>Specifies the ordering of priority for different preemption levels. Two or more job types may be combined at the same priority level with a plus sign ("+") between them, using no whitespace. Comma-separated preemption levels are evaluated left to right, with higher priority to the left. Any level not specified in the <b>preempt_prio</b> list is ignored.<br>For example, express jobs have the highest priority, then normal jobs, and jobs whose entities are over their fairshare limit are third highest:<br>preempt_prio: "express_queue, normal_jobs, fairshare"<br>For example, express jobs whose entities are also over their fairshare limit are lower priority than normal jobs:<br>preempt_prio: "normal_jobs, express_queue+fairshare"   | <i>string array, as quoted list</i> | <b>express_queue</b>     | Jobs in express queues preempt other jobs. See <b>preempt_queue_prio</b> . Does not require <b>by_queue</b> to be <i>True</i> . | "express_queue, normal_jobs" | None               | r    | r    | r, w |
|  |                                     | <b>fairshare</b>         | When the entity owning a job exceeds its fairshare limit.   |                              |                    |      |      |      |
|  |                                     | <b>queue_softlimits</b>  | Jobs which are over their queue soft limits   |                              |                    |      |      |      |
|  |                                     | <b>server_softlimits</b> | Jobs which are over their server soft limits  |                              |                    |      |      |      |
|  |                                     | <b>normal_jobs</b>       | The preemption level into which a job falls if it does not fit into any other specified level.                                  |                              |                    |      |      |      |

| Scheduler Attributes  |  |                             |  |  |                    |      |         |         |
|---|--|-----------------------------|--|--|--------------------|------|---------|---------|
| Name<br>Description   | Format                                       | Val / Opt                   | Value/Option Description                                     | Default<br>Value   | Pyth<br>on<br>Type | User | Oper    | Mgr     |
| <b>preempt_queue_prio</b><br>Specifies the minimum queue priority required for a queue to be classified as an express queue. Express queues do not require <code>by_queue</code> to be <i>True</i> .  | <i>Integer</i>                               |                             |  | <i>150</i>   | None               | r    | r       | r,<br>w |
| <b>preempt_sort</b><br>Specifies how jobs most eligible for preemption are sorted.<br>See <a href="#">"Sorting Within Preemption Level" on page 189 in the PBS Professional Administrator's Guide</a> .   | <i>String</i>                                | <i>min_time_since_start</i> | First job preempted will be that with most recent start time | <i>min_time_since_start</i>  | None               | r    | r       | r,<br>w |
| <b>scheduler_iteration</b><br>Time in seconds between scheduling iterations. If you set the server's <code>scheduler_iteration</code> attribute, that value is assigned to the default scheduler's <code>scheduler_iteration</code> attribute, and vice versa.                | <i>Integer</i> .<br>Units:<br><i>Seconds</i> |                             |  | <i>600</i>   | None               | r    | r       | r,<br>w |
| <b>scheduling</b><br>Enables scheduling of jobs. If you set the server's <code>scheduling</code> attribute, that value is assigned to the default scheduler's <code>scheduling</code> attribute, and vice versa.  | <i>Boolean</i>                               |                             |  | For default scheduler:<br><i>True</i><br>For multi-scheds:<br><i>False</i> | None               | r    | r       | r,<br>w |
| <b>sched_cycle_length</b><br>This scheduler's maximum cycle length. Overwritten by the <code>-a</code> alarm option to <code>pbs_sched</code> command.  | <i>Duration</i>                              |                             |  | <i>20:00</i> (20 minutes)  | None               | r    | r,<br>w | r,<br>w |
| <b>sched_host</b><br>The hostname of the machine on which this scheduler runs.<br>Default value for default scheduler is set by server to server host-name. For a multisched, must be set by administrator.   | <i>String</i>                                |                             |  | <i>Server's host</i>   | None               | -    | r       | r       |
| <b>sched_log</b><br>Directory where this scheduler writes its logs. Permissions should be <i>755</i> . Must be owned by root. Cannot be shared with another scheduler. For default scheduler, directory is always <code>PBS_HOME/sched_log</code> . Settable for multischeds. | <i>String</i>                                |                             |  | <i>\$PBS_HOME/sched_logs_&lt;scheduler name&gt;</i>                        | None               | r    | r       | r,<br>w |
| <b>sched_preempt_enforce_resumption</b><br>Controls whether this scheduler treats preempted jobs as top jobs. When <i>True</i> , preempted jobs are treated as top jobs.  | <i>Boolean</i>                               |                             |  | <i>False</i>   | None               | r    | r       | r,<br>w |

| Scheduler Attributes   |                |                                  |   |   |                    |      |      |      |
|--|----------------|----------------------------------|---|---|--------------------|------|------|------|
| Name<br>Description  | Format         | Val / Opt                        | Value/Option Description  | Default<br>Value  | Pyth<br>on<br>Type | User | Oper | Mgr  |
| <b>sched_priv</b><br>Directory where this scheduler keeps fairshare usage, resource_group, holidays, and sched_config files. Must be owned by root. For default scheduler, directory is always PBS_HOME/sched_priv. Settable for multischeds.  | <i>String</i>  |                                  |   | <code>\$PBS_HOME/sched_priv_&lt;scheduler name&gt;</code> | None               | r    | r    | r, w |
| <b>server_dyn_res_alarm</b><br>Specifies how long this scheduler allows any <code>server_dyn_res</code> script to run. If the script times out, the script is terminated and the scheduler uses zero as the value that would have been returned by the script.   | <i>Integer</i> | <i>0 (zero)</i>                  | No time limit is enforced for <code>server_dyn_res</code> scripts                   | <i>30 seconds</i>   | None               | r    | r    | r, w |
|  |                | <i>&gt;0 (greater than zero)</i> | Value is number of seconds any <code>server_dyn_res</code> script is allowed to run |   |                    |      |      |      |
| <b>state</b><br>State of this scheduler. Set by server.  | <i>String</i>  | <i>down</i>                      | Scheduler is not running  | For default scheduler: idle<br>For multi-sched: down      | None               | r    | r    | r    |
|  |                | <i>idle</i>                      | Scheduler is running and is waiting for a scheduling cycle to be triggered          |   |                    |      |      |      |
|  |                | <i>scheduling</i>                | Scheduler is running and is in a scheduling cycle                                   |   |                    |      |      |      |
| <b>throughput_mode</b><br><b>Deprecated.</b> Use <code>job_run_wait</code> scheduler attribute instead. Allows scheduler to run faster; it doesn't have to wait for each job to be accepted, and doesn't wait for <code>execjob_begin</code> hooks to finish.<br>Also allows jobs that were changed via <code>qalter</code> , <code>server_dyn_res</code> scripts, or peering to run in the same scheduling cycle where they were changed. | <i>Boolean</i> | <i>True</i>                      | Scheduler runs asynchronously and faster.   | True  | None               | r    | r, w | r, w |
|  |                | <i>False</i>                     | Scheduler does not run asynchronously   |   |                    |      |      |      |

## 6.8 Reservation Attributes

| Reservation Attributes  |   |           |                             |  |                      |         |             |
|---|---|-----------|-----------------------------|--|----------------------|---------|-------------|
| Name<br>Description   | Format  | Val / Opt | Value/Option<br>Description | Def Val  | Python Type          | User    | Oper<br>Mgr |
| Account_Name<br>No longer used.   |   |           |                             |  |                      | -       | -           |
| Authorized_Groups<br>List of groups who can or cannot submit jobs to this reservation. Group names are interpreted relative to the server, not the submission host. List is evaluated left-to-right; first match in list is used. This list is used to set the reservation queue's <code>acl_groups</code> attribute. See the <code>G</code> option to the <code>pbs_rsub</code> command. | <i>String</i> . Syntax:<br>[+ -]<group name> [, [+ -]<group name> ...]<br>where '-' means "deny" and '+' means "allow".   |           |                             | No default. (Jobs can be submitted by all groups)  | <code>pbs.acl</code> | r,<br>w | r,<br>w     |
| Authorized_Hosts<br>The list of hosts from which jobs can and cannot be submitted to this reservation. List is evaluated left-to-right; first match in list is used. This list is used to set the reservation queue's <code>acl_hosts</code> attribute. See the <code>H</code> option to the <code>pbs_rsub</code> command.   | <i>String</i> . Syntax:<br>[+ -]<hostname> [, [+ -]<hostname> ...]<br>where '-' means "deny" and '+' means "allow".<br>Hostnames may be wildcarded using an asterisk, according to the following rules:<br>A hostname can contain at most one asterisk<br>The asterisk must be the leftmost label<br>Examples:<br><code>*.test.example.com</code><br><code>*.example.com</code><br><code>*.com</code> |           |                             | No default. (Jobs can be submitted from all hosts) | <code>pbs.acl</code> | r,<br>w | r,<br>w     |



| Reservation Attributes   |  |           |                             |   |                           |      |      |
|--|--|-----------|-----------------------------|---|---------------------------|------|------|
| Name<br>Description  | Format   | Val / Opt | Value/Option<br>Description | Def Val   | Python Type               | User | Mgr  |
| <b>Authorized_Users</b><br>The list of users who can or cannot submit jobs to this reservation. List is evaluated left-to-right; first match in list is used. This list is used to set the reservation queue's <code>acl_users</code> attribute. See the <code>U</code> option to the <code>pbs_rsub</code> command. | <b>String.</b> Syntax:<br><code>[+ -]&lt;user-name&gt;[@&lt;host-name&gt;.&lt;domain&gt;] [, [+ -]&lt;user-name&gt;[@&lt;host-name&gt;.&lt;domain&gt;] ...]</code><br>where '-' means "deny" and '+' means "allow".<br>Hostnames may be wild-carded using an asterisk, according to the following rules:<br>A hostname can contain at most one asterisk<br>The asterisk must be the leftmost label in the hostname<br>Examples:<br><code>*.test.example.com</code><br><code>*.example.com</code><br><code>*.com</code> |           |                             | Reservation owner only                                  | <code>pbs.acl</code>      | r, w | r, w |
| <b>ctime</b><br>Timestamp; time at which the reservation was created.  | <b>Timestamp.</b><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.  |           |                             | No default  | <code>int</code>          | r    | r    |
| <b>delete_idle_time</b><br>Amount of time a reservation can sit idle before it is deleted. Applies to each instance of a standing reservation.   | <b>Duration.</b> Syntax: either <i>integer seconds</i> or <i>HHHH:MM:SS</i>  |           |                             | None except for ASAP reservations:<br><i>10 minutes</i> | <code>pbs.duration</code> | r, w | r, w |

| Reservation Attributes  |  |                           |   |                        |                 |         |         |         |
|---|--|---------------------------|---|------------------------|-----------------|---------|---------|---------|
| Name<br>Description   | Format   | Val / Opt                 | Value/Option<br>Description   | Def Val                | Python Type     | User    | Oper    | Mgr     |
| group_list<br>No longer used.   |  |                           |   |                        |                 | -       | -       | -       |
| hashname<br>No longer used.   |  |                           |   |                        |                 | -       | -       | -       |
| interactive<br>Number of seconds that the pbs_rsub command will block while waiting for confirmation or denial of the reservation. See the -I block_time option to the pbs_rsub command.                    | <i>Integer</i>   | Less than zero            | The reservation is automatically deleted if it cannot be confirmed in the time specified.     | <i>Zero</i>            | int             | r,<br>w | r,<br>w | r,<br>w |
|   |  | Zero or greater than zero | The reservation is not automatically deleted if it cannot be confirmed in the time specified. |                        |                 |         |         |         |
| Mail_Points<br>Sets the list of events for which mail is sent by the server. Mail is sent to the list of users specified in the Mail_Users attribute. See the m mail_points option to the pbs_rsub command. | <i>String</i> consisting of 1) one or more of the letters "a", "b", "c", "e", or 2) the string "n". Cannot use "n" with any other letter | <i>a</i>                  | Notify when reservation is terminated   | <i>"ac"</i>            | pbs.mail_points | r,<br>w | r,<br>w | r,<br>w |
|   |  | <i>b</i>                  | Notify when reservation period begins   |                        |                 |         |         |         |
|   |  | <i>c</i>                  | Notify when reservation is confirmed  |                        |                 |         |         |         |
|   |  | <i>e</i>                  | Notify when reservation period ends   |                        |                 |         |         |         |
|   |  | <i>n</i>                  | Do not send mail. Cannot be used with other letters.  |                        |                 |         |         |         |
| Mail_Users<br>The set of users to whom mail is sent for the reservation events specified in the Mail_Points attribute. See the M mail_list option to the pbs_rsub command.                                  | <i>String</i> . Syntax: <user-name>@<host-name>[,<username>@<hostname>, ...]   |                           |   | Reservation owner only | pbs.user_list   | r,<br>w | r,<br>w | r,<br>w |

| Reservation Attributes   |   |           |                             |         |              |         |         |         |
|--|---|-----------|-----------------------------|---------|--------------|---------|---------|---------|
| Name<br>Description  | Format  | Val / Opt | Value/Option<br>Description | Def Val | Python Type  | User    | Oper    | Mgr     |
| <b>mtime</b><br>Timestamp: the time that the reservation was last modified.  | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.   |           |                             |         | int          | r       | r       | r       |
| <b>Priority</b><br>No longer used.   |   |           |                             |         |              | -       | -       | -       |
| <b>queue</b><br>Name of the reservation queue. Jobs that are to use resources belonging to this reservation are submitted to this queue. | <i>String.</i> Format for an advance or job-specific reservation: <i>R&lt;sequence number&gt;</i><br>Format for a standing reservation: <i>S&lt;sequence number&gt;</i>   |           |                             |         | pbs.queue    | r       | r       | r       |
| <b>reserve_count</b><br>The count of occurrences in a standing reservation.  | <i>Integer</i>  |           |                             |         | int          | r,<br>w | r,<br>w | r,<br>w |
| <b>reserve_duration</b><br>Reservation duration in seconds. For a standing reservation, this is the duration for one occurrence.         | <i>Integer</i>  |           |                             |         | pbs.duration | r,<br>w | r,<br>w | r,<br>w |
| <b>reserve_end</b><br>The date and time when an advance reservation or the soonest occurrence of a standing reservation ends.            | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.   |           |                             |         | int          | r,<br>w | r,<br>w | r,<br>w |
| <b>reserve_ID</b><br>The reservation identifier.   | <i>String.</i> For an advance or job-specific reservation: string of the form <i>R&lt;sequence number&gt;.&lt;server name&gt;</i><br>For a standing reservation: string of the form <i>S&lt;sequence number&gt;.&lt;server name&gt;</i> |           |                             |         | str          | r       | r       | r       |

| Reservation Attributes  |   |           |                             |                       |             |      |      |      |
|---|---|-----------|-----------------------------|-----------------------|-------------|------|------|------|
| Name<br>Description   | Format  | Val / Opt | Value/Option<br>Description | Def Val               | Python Type | User | Oper | Mgr  |
| <b>reserve_index</b><br>The index of the soonest occurrence of a standing reservation.  | <i>Integer</i>  |           |                             |                       | int         | r    | r    | r    |
| <b>reserve_job</b><br>If this reservation is a job-specific start or now reservation, shows the ID of the job from which the reservation was created. | <i>String</i>   |           |                             | No default            | str         | r    | r    | r    |
| <b>Reserve_Name</b><br>The name assigned to the reservation during creation, if specified. See the N option to the pbs_rsub command.                  | <i>String</i> . Syntax: up to 236 characters. First character is alphabetic   |           |                             | No default            | str         | r, w | r, w | r, w |
| <b>Reserve_Owner</b><br>The login name on the submission host of the user who created the reservation.  | <i>String</i> . Syntax: <user-name>@<hostname>  |           |                             | Login name of creator | str         | r    | r    | r    |
| <b>reserve_retry</b><br>If this reservation becomes degraded, this is the next time that PBS will attempt to reconfirm this reservation.              | <i>Timestamp</i> .<br>Printed by qstat in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |           |                             | No default            | int         | r    | r    | r    |

| Reservation Attributes   |  |                      |   |            |             |      |      |
|--|--|----------------------|---|------------|-------------|------|------|
| Name<br>Description  | Format   | Val / Opt            | Value/Option<br>Description   | Def Val    | Python Type | User | Oper |
| <b>reserve_rule</b><br>The rule that describes the recurrence pattern of a standing reservation. See the <code>r</code> option to the <code>pbs_rsub</code> command. | <i>String</i> . Syntax: either of two forms:<br><i>"FREQ= &lt;freq_spec&gt;;<br/>           COUNT= &lt;count_spec&gt;;<br/>           &lt;interval_spec&gt;"</i><br>or<br><i>"FREQ= &lt;freq_spec&gt;;<br/>           UNTIL= &lt;until_spec&gt;;<br/>           &lt;interval_spec&gt;"</i> | <i>freq_spec</i>     | Frequency with which the standing reservation repeats. Valid values are: <i>WEEKLY DAILY HOURLY</i>   | No default | str         | r, s | r, w |
|  |  | <i>count_spec</i>    | The exact number of occurrences. Number up to 4 digits in length. Format: <i>integer</i> .  | No default |             |      |      |
|  |  | <i>interval_spec</i> | Specifies interval. Format is one or both of: <i>BYDAY = MO TU WE TH FR SA SU</i> or <i>BYHOUR = 0 1 2 ... 23</i>   | No default |             |      |      |
|  |  | <i>until_spec</i>    | Occurrences will start up to but not after date and time specified. Format: <i>YYYYM-MDD[THHMMSS]</i> Year-month-day part and hour-minute-second part separated by a capital <i>T</i> . | No default |             |      |      |
| <b>reserve_start</b><br>The date and time when the reservation period for the reservation or soonest occurrence begins.  | <i>Timestamp</i> .<br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.   |                      |   | No default | int         | r, w | r, w |

## Attributes

| Reservation Attributes   |                |                              |   |            |   |      |             |
|--|----------------|------------------------------|---|------------|---|------|-------------|
| Name<br>Description  | Format         | Val / Opt                    | Value/Option<br>Description                                   | Def Val    | Python Type   | User | Oper<br>Mgr |
| reserve_state<br>The state of the reservation.   | <i>String</i>  | <i>NO RESV_NONE</i>          | No reservation yet.   | No default | Reservation state constant:<br>pbs.RESV_STATE_NONE          | r    | r           |
|  |                | <i>UN RESV_UNCONFIRMED</i>   | Reservation request is awaiting confirmation.                 |            | Reservation state constant:<br>pbs.RESV_STATE_UNCONFIRMED   |      |             |
|  |                | <i>CO RESV_CONFIRMED</i>     | Resv. confirmed. All occurrences of standing resv. confirmed. |            | Reservation state constant:<br>pbs.RESV_STATE_CONFIRMED     |      |             |
|  |                | <i>WT RESV_WAIT</i>          | Unused.   |            | Reservation state constant:<br>pbs.RESV_STATE_WAIT          |      |             |
|  |                | <i>TR RESV_TIME_TO_RUN</i>   | Start of the reservation period.                              |            | Reservation state constant:<br>pbs.RESV_STATE_TIME_TO_RUN   |      |             |
|  |                | <i>RN RESV_RUNNING</i>       | Resv. period has started; reservation is running.             |            | Reservation state constant:<br>pbs.RESV_STATE_RUNNING       |      |             |
|  |                | <i>FN RESV_FINISHED</i>      | End of the reservation period.                                |            | Reservation state constant:<br>pbs.RESV_STATE_FINISHED      |      |             |
|  |                | <i>BD RESV_BEING_DELETED</i> | Reservation is being deleted.                                 |            | Reservation state constant:<br>pbs.RESV_STATE_BEING_DELETED |      |             |
|  |                | <i>DE RESV_DELETED</i>       | Reservation has been deleted.                                 |            | Reservation state constant:<br>pbs.RESV_STATE_DELETED       |      |             |
|  |                | <i>DJ RESV_DELETING_JOBS</i> | Jobs belonging to the reservation are being deleted           |            | Reservation state constant:<br>pbs.RESV_STATE_DELETING_JOBS |      |             |
|  |                | <i>DG DEGRADED</i>           | Reservation is degraded.                                      |            | Reservation state constant:<br>pbs.RESV_STATE_DEGRADED      |      |             |
| reserve_substate<br>The substate of the reservation or occurrence. The substate is used internally by PBS. | <i>Integer</i> |                              |   | No default | int   | r    | r           |
| reserve_type<br>No longer used.  |                |                              |   |            |   | -    | -           |

| Reservation Attributes  |   |           |                             |            |  |         |         |         |
|---|---|-----------|-----------------------------|------------|--|---------|---------|---------|
| Name<br>Description   | Format  | Val / Opt | Value/Option<br>Description | Def Val    | Python Type  | User    | Oper    | Mgr     |
| <b>Resource_List</b><br>The list of resources allocated to the reservation. Jobs running in the reservation cannot use in aggregate more than the specified amount of a resource.                       | <i>String</i> . Syntax:<br><i>Resource_List</i> .<resource name>=<value>[,<br><i>Resource_List</i> .<resource name>=<value>, ...]                                     |           |                             | No default | pbs.pbs_resource<br>Syntax: <i>Resource_List</i> ["<resource name>"]=<value> where <i>resource name</i> is any built-in or custom resource | r,<br>w | r,<br>w | r,<br>w |
| <b>resv_nodes</b><br>The list of each vnode and the resources allocated from it to satisfy the chunks requested for this reservation or occurrence. For a maintenance reservation, value is set by PBS. | <i>String</i> . Syntax: (<vnode name>:<resource name>=<value>[:<resource name>=<value>]...)<br>[+(<vnode name>:<resource name>=<value>[:<resource name>=<value>])...] |           |                             | No default | pbs.exec_vnode   | r       | r       | r       |
| <b>server</b><br>Name of server.  | <i>String</i>   |           |                             | No default | pbs.server   | r       | r       | r       |
| <b>User_List</b><br>No longer used.   |   |           |                             |            |  | -       | -       | -       |
| <b>Variable_List</b><br>Not used  |   |           |                             |            |  | -       | -       | -       |

## 6.9 Queue Attributes

In the following table, Queue Type indicates the type of queue to which the attribute applies: R (routing), E (execution):

| Queue Attributes   |  |               |                    |  |  |             |       |      |      |
|--|--|---------------|--------------------|--|--|-------------|-------|------|------|
| Name<br>Description  | Format   | Queue<br>Type | Value or<br>Option | Value or Option<br>Description   | Default<br>Value                         | Python Type | Unset | Opet | Mgr  |
| <b>acl_group_enable</b><br>Controls whether group access to the queue obeys the access control list defined in the <code>acl_groups</code> queue attribute.  | <i>Boolean</i>   | R, E          |                    | When set to <i>True</i> , group access to the queue is limited according to the group access control list. | <i>False</i> ; all groups allowed access | bool        | r     | r, w | r, w |
| <b>acl_groups</b><br>List of groups which are allowed or denied access to this queue. The groups in the list are groups on the server host, not submitting hosts. List is evaluated left-to-right; first match in list is used.                    | <i>String</i> . Syntax:<br>[+ -] <group name>[, ...]           | R, E          |                    |  | No default                               | pbs.acl     | r     | r, w | r, w |
| <b>acl_host_enable</b><br>Controls whether host access to the queue obeys the access control list defined in the <code>acl_hosts</code> queue attribute.   | <i>Boolean</i>   | R, E          |                    | When set to <i>True</i> , host access to the queue is limited according to the host access control list.   | <i>False</i> ; all hosts allowed access. | bool        | r     | r, w | r, w |
| <b>acl_hosts</b><br>List of hosts from which jobs may be submitted to this queue. List is evaluated left-to-right; first match in list is used.  | <i>String</i> . Syntax:<br>[+ -]<hostname>[, ...]              | R, E          |                    |  | No default                               | pbs.acl     | r     | r, w | r, w |
| <b>acl_user_enable</b><br>Controls whether user access to the queue obeys the access control list defined in the <code>acl_users</code> queue attribute.   | <i>Boolean</i>   | R, E          |                    | When set to <i>True</i> , user access to the queue is limited according to the user access control list.   | <i>False</i> ; all users allowed access  | bool        | r     | r, w | r, w |
| <b>acl_users</b><br>List of users allowed or denied access to this queue. List is evaluated left-to-right; first match in list is used.  | <i>String</i> . Syntax:<br>[+ -]<username>[@<hostname>][, ...] | R, E          |                    |  | No default                               | pbs.acl     | r     | r, w | r, w |
| <b>alt_router</b><br>No longer used.   |  |               |                    |  |  |             | -     | -    | -    |
| <b>backfill_depth</b><br>Specifies backfilling behavior for this queue. Sets the number of jobs that are to be backfilled around in this queue. Overrides <code>backfill_depth</code> server attribute. Recommendation: set this to less than 100. | <i>Integer</i> .<br>Must be $\geq 0$ .                         | E             | $\geq 0$           | PBS backfills around the specified number of jobs.   | Unset. When unset, backfill depth is 1   | int         | r, w  | r, w | r, w |
|  |  |               | <i>Unset</i>       | Backfill depth is set to 1   |  |             |       |      |      |



| Queue Attributes   |   |               |                    |  |   |  |      |      |      |
|--|---|---------------|--------------------|--|---|--|------|------|------|
| Name<br>Description  | Format  | Queue<br>Type | Value or<br>Option | Value or Option<br>Description   | Default<br>Value  | Python Type  | User | Oper | Mgt  |
| <b>checkpoint_min</b><br>Minimum number of minutes of CPU time or walltime allowed between checkpoints of a job. If a user specifies a time less than this value, this value is used instead. The value given in <code>checkpoint_min</code> is used for both CPU minutes and walltime minutes.            | <i>Integer</i>  | E             |                    |  | No default  | <code>pbs.duration</code>  | r    | r, w | r, w |
| <b>default_chunk</b><br>The list of resources which will be inserted into each chunk of a job's select specification if the corresponding resource is not specified by the user. This provides a means for a site to be sure a given resource is properly accounted for even if not specified by the user. | <i>String</i> . Syntax:<br><code>default_chunk.&lt;resource name&gt;=&lt;value&gt;[, default_chunk.&lt;resource name&gt;=&lt;value&gt;, ...]</code> | E             |                    |  | No default  | <code>pbs.pbs_resource</code><br>Syntax:<br><code>default_chunk["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |
| <b>enabled</b><br>Specifies whether this queue accepts new jobs.   | <i>Boolean</i>  | R, E          | <i>True</i>        | This queue is <i>enabled</i> . This queue accepts new jobs; new jobs can be enqueued.              | <i>False</i>  | bool   | r    | r, w | r, w |
|  |   |               | <i>False</i>       | This queue does not accept new jobs.   |   |  |      |      |      |
| <b>from_route_only</b><br>Specifies whether this queue accepts jobs only from routing queues, or from both execution and routing queues.   | <i>Boolean</i>  | R, E          | <i>True</i>        | This queue accepts jobs only from routing queues.  | <i>False</i>  | bool   | r    | r    | r, w |
|  |   |               | <i>False</i>       | This queue accepts jobs from both execution and routing queues as well as directly from submitter. |   |  |      |      |      |
| <b>hasnodes</b><br><b>Deprecated.</b> Indicates whether vnodes are associated with this queue.<br>Set by PBS.  | <i>Boolean</i>  | E             |                    | This attribute is set to <i>True</i> if there are vnodes associated with this queue.               | <i>False</i> ; no vnodes are associated with this queue | bool   | r    | r    | r, i |

| Queue Attributes   |  |               |   |                                |                   |  |      |          |      |
|--|--|---------------|---|--------------------------------|-------------------|--|------|----------|------|
| Name<br>Description  | Format   | Queue<br>Type | Value or<br>Option  | Value or Option<br>Description | Default<br>Value  | Python Type  | User | Operator | Mgr  |
| <b>kill_delay</b><br>The time delay between sending SIGTERM and SIGKILL when a qdel command is issued against a running job.   | <i>Integer</i> . Units: <i>Seconds</i> . Must be greater than or equal to <i>zero</i> .  | E             |   |                                | <i>10 seconds</i> | pbs.duration   | r    | r, w     | r, w |
| <b>max_array_size</b><br>The maximum number of subjobs that are allowed in an array job.   | <i>Integer</i>   | R, E          |   |                                | No default        | int  | r    | r, w     | r, w |
| <b>max_group_res</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum amount of the specified resource that any single group may consume in a complex.  | <i>String</i> . Syntax:<br><i>max_group_res.&lt;resource name&gt;=&lt;value&gt;</i><br>Example: set queue workq<br>max_group_res.ncpus=6           | E             | Any PBS resource, e.g. "ncpus", "mem", "pmem", etc.       |                                | No default        | pbs.pbs_resource<br>Syntax:<br><i>max_group_res["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource      | r    | r, w     | r, w |
| <b>max_group_res_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit on the amount of the specified resource that any single group may consume in a complex. If a group is consuming more than this amount of the specified resource, their jobs are eligible to be preempted by jobs from groups who are not over their soft limit. | <i>String</i> . Syntax:<br><i>max_group_res_soft.&lt;resource name&gt;=&lt;value&gt;</i><br>Example: set queue workq<br>max_group_res_soft.ncpus=3 | E             | Any valid PBS resource, e.g. "ncpus", "mem", "pmem", etc. |                                | No default        | pbs.pbs_resource<br>Syntax:<br><i>max_group_res_soft["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w     | r, w |
| <b>max_group_run</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by users in a single group that are allowed to be running from this queue at one time.   | <i>Integer</i>   | E             |   |                                | No default        | int  | r    | r, w     | r, w |
| <b>max_group_run_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by users in a single group that are allowed to be running from this queue at one time. If a group has more than this number of jobs running, their jobs are eligible to be preempted by jobs from groups who are not over their soft limit.   | <i>Integer</i>   | E             |   |                                | No default        | int  | r    | r, w     | r, w |

| Queue Attributes   |   |               |                    |                                |                       |  |      |      |      |
|--|---|---------------|--------------------|--------------------------------|-----------------------|--|------|------|------|
| Name<br>Description  | Format  | Queue<br>Type | Value or<br>Option | Value or Option<br>Description | Default<br>Value      | Python Type  | User | Oper | Mgt  |
| <b>max_queueable</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs allowed to reside in this queue at any given time.   | <i>Integer</i>  | R, E          |                    |                                | No default (no limit) | int  | r    | r, w | r, w |
| <b>max_queued</b><br>Limit attribute. The maximum number of jobs allowed to be queued in or running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a>  | R, E          |                    |                                | No default            | pbs.pbs_resource<br>Syntax:<br><i>max_queued["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource     | r    | r, w | r, w |
| <b>max_queued_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs queued in or running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes. | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a><br>Syntax:<br><i>max_queued_res.&lt;resource name&gt;=&lt;value&gt;</i>                | R, E          |                    |                                | No default            | pbs.pbs_resource<br>Syntax:<br><i>max_queued_res["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |
| <b>max_run</b><br>Limit attribute. The maximum number of jobs allowed to be running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Format: <i>Limit specification</i> . See <a href="#">Chapter 7, "Formats", on page 357</a>  | E             |                    |                                | No default            | pbs.pbs_resource<br>Syntax:<br><i>max_run["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource        | r    | r, w | r, w |
| <b>max_run_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.                 | Format: <i>Limit specification</i> . See <a href="#">Chapter 7, "Formats", on page 357</a> .<br>Syntax:<br><i>max_run_res.&lt;resource name&gt;=&lt;value&gt;</i> | E             |                    |                                | No default            | pbs.pbs_resource<br>Syntax:<br><i>max_run_res["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource    | r    | r, w | r, w |

| Queue Attributes  |  |               |  |                                |                  |  |      |      |      |
|---|--|---------------|--|--------------------------------|------------------|--|------|------|------|
| Name<br>Description   | Format   | Queue<br>Type | Value or<br>Option                                       | Value or Option<br>Description | Default<br>Value | Python Type  | User | Oper | Mgt  |
| <b>max_run_res_soft</b><br>Limit attribute. Soft limit on the amount of the specified resource allowed to be allocated to jobs running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Format: Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .<br>Syntax:<br><code>max_run_res_soft.&lt;resource name&gt;=&lt;value&gt;</code> | E             |  |                                | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><code>max_run_res_soft["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource  | r    | r, w | r, w |
| <b>max_run_soft</b><br>Limit attribute. Soft limit on the number of jobs allowed to be running from this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .   | E             |  |                                | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><code>max_run_soft["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource      | r    | r, w | r, w |
| <b>max_running</b><br>Old limit attribute. Incompatible with new limit attributes. For an execution queue, this is the largest number of jobs allowed to be running at any given time. For a routing queue, this is the largest number of jobs allowed to be transiting from this queue at any given time.  | <i>Integer</i>   | R, E          |  |                                | No default       | int  | r    | r, w | r, w |
| <b>max_user_res</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum amount of the specified resource that any single user may consume.  | <i>String</i> . Syntax:<br><code>max_user_res.&lt;resource name&gt;=&lt;value&gt;</code><br>Example: set queue workq<br><code>max_user_res.ncpus=6</code>            | E             | any PBS resource, e.g. "ncpus", "mem", "pmem", etc       |                                | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><code>max_user_res["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource      | r    | r, w | r, w |
| <b>max_user_res_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit on the amount of the specified resource that any single user may consume. If a user is consuming more than this amount of the specified resource, their jobs are eligible to be preempted by jobs from users who are not over their soft limit. | <i>String</i> . Syntax:<br><code>max_user_res_soft.&lt;resource name&gt;=&lt;value&gt;</code><br>Example: set queue workq<br><code>max_user_res_soft.ncpus=3</code>  | E             | any valid PBS resource, e.g. "ncpus", "mem", "pmem", etc |                                | No default       | <code>pbs.pbs_resource</code><br>Syntax:<br><code>max_user_res_soft["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |

| Queue Attributes  |   |               |                             |                                |                  |   |      |      |      |
|---|---|---------------|-----------------------------|--------------------------------|------------------|---|------|------|------|
| Name<br>Description   | Format  | Queue<br>Type | Value or<br>Option          | Value or Option<br>Description | Default<br>Value | Python Type   | User | Oper | Mgt  |
| <b>max_user_run</b><br>Old limit attribute. Incompatible with new limit attributes. The maximum number of jobs owned by a single user that are allowed to be running from this queue at one time.   | <i>Integer</i>  | E             |                             |                                | No default       | int   | r    | r, w | r, w |
| <b>max_user_run_soft</b><br>Old limit attribute. Incompatible with new limit attributes. The soft limit on the number of jobs owned by any single user that are allowed to be running from this queue at one time. If a user has more than this number of jobs running, their jobs are eligible to be preempted by jobs from users who are not over their soft limit.       | <i>Integer</i>  | E             |                             |                                | No default       | int   | r    | r, w | r, w |
| <b>node_group_key</b><br>Specifies the resources to use for placement sets (node grouping). Overrides server's <b>node_group_key</b> attribute. Specified resources must be of type <b>string_array</b> .   | <i>String_array</i> . Syntax: Comma-separated list of resource names. When specifying multiple resources, enclose value in double quotes. | R, E          |                             |                                | No default       | pbs.node_group_key  | r    | r, w | r, w |
| <b>partition</b><br>Name of partition to which this queue is assigned. Cannot be set for routing queue. An execution queue cannot be changed to a routing queue while this attribute is set.  | <i>String</i>   | E             |                             |                                | No default       | str   | r    | r    | r, w |
| <b>Priority</b><br>The priority of this queue compared to other queues of the same type in this PBS complex. Priority can define a queue as an express queue. See <a href="#">preempt_queue_prio</a> in <a href="#">Chapter 4, "Scheduler Parameters", on page 257</a> .<br>Used for execution queues only; the value of <b>Priority</b> has no meaning for routing queues. | <i>Integer</i>  | E             | Valid values: -1024 to 1023 |                                | No default       | int   | r    | r, w | r, w |
| <b>queued_jobs_threshold</b><br>Limit attribute. The maximum number of jobs allowed to be queued in this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes.   | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .  | R, E          |                             |                                | No default       | pbs.pbs_resource<br>Syntax:<br><code>queued_jobs_threshold["&lt;resource name&gt;"]=&lt;value&gt;</code><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |

| Queue Attributes  |   |               |                     |   |                  |   |      |      |      |
|---|---|---------------|---------------------|---|------------------|---|------|------|------|
| Name<br>Description   | Format  | Queue<br>Type | Value or<br>Option  | Value or Option<br>Description  | Default<br>Value | Python Type   | User | Oper | Mgt  |
| <b>queued_jobs_threshold_res</b><br>Limit attribute. The maximum amount of the specified resource allowed to be allocated to jobs queued in this queue. Can be specified for projects, users, groups, or all. Cannot be used with old limit attributes. | Limit specification. See <a href="#">Chapter 7, "Formats", on page 357</a> .<br>Syntax:<br><i>"queued_jobs_threshold_res.&lt;resource name&gt;=&lt;value&gt;"</i>         | R, E          |                     |   | No default       | pbs.pbs_resource<br>Syntax:<br><i>queued_jobs_threshold_res["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |
| <b>queue_type</b><br>The type of this queue. This attribute must be explicitly set at queue creation.   | String  | R, E          | "e",<br>"execution" | Execution queue   | No default       | PBS queue type constant:<br>pbs.QUEUETYPE_EXECUTION   | r    | r, w | r, w |
|   |   |               | "r",<br>"route"     | Routing queue   |                  | PBS queue type constant:<br>pbs.QUEUETYPE_ROUTE   |      |      |      |
| <b>require_cred</b><br><b>Obsolete (2020.1)</b><br>Specifies the credential type required. All jobs submitted to the named queue without the specified credential will be rejected.   | String  | R, E          | krb5                |   | unset            | str   | r    | r    | r, w |
|   |   |               | dce                 |   |                  |   |      |      |      |
| <b>require_cred_enable</b><br><b>Obsolete (2020.1)</b><br>Specifies whether the credential authentication method specified in the <b>require_cred</b> queue attribute is required for this queue.   | Boolean   | R, E          |                     | When set to <i>True</i> , the credential authentication method is required. | False            | bool  | r    | r    | r, w |
| <b>resources_assigned</b><br>The total for each kind of resource allocated to running and exiting jobs in this queue.   | String. Syntax:<br><i>resources_assigned.&lt;resource name&gt;=&lt;value&gt;&lt;new line&gt;resources_assigned.&lt;resource name&gt;=&lt;value&gt;&lt;new line&gt;...</i> | E             |                     |   | No default       | pbs.pbs_resource<br>Syntax:<br><i>resources_assigned["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource        | r    | r    | r    |

| Queue Attributes  |   |               |                    |                                |                            |   |      |      |      |
|---|---|---------------|--------------------|--------------------------------|----------------------------|---|------|------|------|
| Name<br>Description   | Format  | Queue<br>Type | Value or<br>Option | Value or Option<br>Description | Default<br>Value           | Python Type   | User | Oper | Mgt  |
| <b>resources_available</b><br>The list of resources and amounts available to jobs running in this queue. The sum of the resource of each type used by all jobs running from this queue cannot exceed the total amount listed here.  | <b>String.</b> Syntax:<br><i>resources_available.&lt;resource name&gt;=&lt;value&gt;&lt;new line&gt;</i><br><i>resources_available.&lt;resource name&gt;=&lt;value&gt;&lt;new line&gt;...</i> | E             |                    |                                | No default                 | pbs.pbs_resource<br>Syntax:<br><i>resources_available["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource | r    | r, w | r, w |
| <b>resources_default</b><br>The list of default resource values which are set as limits for a job residing in this queue and for which the job did not specify a limit. If not set, the default limit for a job is determined by the first of the following attributes which is set: server's <b>resources_default</b> , queue's <b>resources_max</b> , server's <b>resources_max</b> . If none of these is set, the job gets unlimited resource usage. | <b>String.</b> Syntax:<br><i>resources_default.&lt;resource name&gt;=&lt;value&gt;</i> ,<br><i>resources_default.&lt;resource name&gt;=&lt;value&gt;</i> , ...                                | R, E          |                    |                                | No default                 | pbs.pbs_resource<br>Syntax:<br><i>resources_default["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource   | r    | r, w | r, w |
| <b>resources_max</b><br>The maximum amount of each resource that can be requested by a single job in this queue. This queue value supersedes any server wide maximum limit.   | <b>String.</b> Syntax:<br><i>resources_max.&lt;resource name&gt;=&lt;value&gt;</i> ,<br><i>resources_max.&lt;resource name&gt;=&lt;value&gt;</i> , ...  | R, E          |                    |                                | No default; infinite usage | pbs.pbs_resource<br>Syntax:<br><i>resources_max["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource       | r    | r, w | r, w |
| <b>resources_min</b><br>The minimum amount of each resource that can be requested by a single job in this queue.  | <b>String.</b> Syntax:<br><i>resources_max.&lt;resource name&gt;=&lt;value&gt;</i> ,<br><i>resources_max.&lt;resource name&gt;=&lt;value&gt;</i> , ...  | R, E          |                    |                                | No default; zero usage     | pbs.pbs_resource<br>Syntax:<br><i>resources_min["&lt;resource name&gt;"]=&lt;value&gt;</i><br>where <i>resource name</i> is any built-in or custom resource       | r    | r, w | r, w |



| Queue Attributes   |   |               |                    |  |                    |                        |      |          |         |
|--|---|---------------|--------------------|--|--------------------|------------------------|------|----------|---------|
| Name<br>Description  | Format  | Queue<br>Type | Value or<br>Option | Value or Option<br>Description   | Default<br>Value   | Python Type            | User | Operator | Mgr     |
| <b>route_destinations</b><br>The list of destinations to which jobs may be routed.<br>Must be set to at least one valid destination.   | <i>String.</i> Syntax:<br>comma-separated<br>strings:<br><queue name><br>[@<server host><br>[:port]]<br>Example: Q1,<br>Q2@remote,<br>Q3@remote:15501 | R             |                    |  | No<br>default      | pbs.route_destinations | r    | r        | r,<br>w |
| <b>route_held_jobs</b><br>Specifies whether jobs in the held state can be routed from this queue.  | <i>Boolean</i>  | R             |                    | When <i>True</i> , jobs with a hold can be routed from this queue.                                   | <i>False</i>       | bool                   | r    | r,<br>w  | r,<br>w |
| <b>route_lifetime</b><br>The maximum time a job is allowed to reside in this routing queue. If a job cannot be routed in this amount of time, the job is aborted.                | <i>Integer.</i><br>Units: <i>Seconds</i>  | R             | >0                 | Jobs can reside for specified number of seconds  | Unset;<br>infinite | pbs.duration           | r    | r,<br>w  | r,<br>w |
|  |   |               | 0                  | Infinite   |                    |                        |      |          |         |
|  |   |               | unset              | Infinite   |                    |                        |      |          |         |
| <b>route_retry_time</b><br>Time delay between routing retries. Typically used when the network between servers is down.  | <i>Integer.</i><br>Units: <i>Seconds</i>  | R             |                    |  | 30 <i>seconds</i>  | pbs.duration           | r    | r,<br>w  | r,<br>w |
| <b>route_waiting_jobs</b><br>Specifies whether jobs whose <b>Execution_Time</b> attribute value is in the future can be routed from this queue.                                  | <i>Boolean</i>  | R             |                    | When <i>True</i> , jobs with a future <b>Execution_Time</b> attribute can be routed from this queue. | <i>False</i>       | bool                   | r    | r,<br>w  | r,<br>w |
| <b>started</b><br>If this is an execution queue, specifies whether jobs in this queue can be scheduled for execution, or if this is a routing queue, whether jobs can be routed. | <i>Boolean</i>  | R, E          |                    | When <i>True</i> , jobs in this queue can run or be routed   | <i>False</i>       | bool                   | r    | r,<br>w  | r,<br>w |
| <b>state_count</b><br>The number of jobs in each state currently residing in this queue.   | <i>String.</i> Syntax: <i>transiting=&lt;value&gt;, exiting=&lt;value&gt;, ...</i>  | R, E          |                    |  | No<br>default      | pbs.state_count        | r    | r        | r       |
| <b>total_jobs</b><br>The number of jobs currently residing in this queue.  | <i>Integer</i>  | R, E          |                    |  | No<br>default      | int                    | r    | r        | r       |



## 6.10 Vnode Attributes

| Vnode Attributes   |  |              |                                |            |             |   |      |      |
|--|--|--------------|--------------------------------|------------|-------------|---|------|------|
| Name<br>Description  | Format   | Val / Opt    | Value/Option Description       | Def Val    | Python Type | U | Op   | M    |
| <b>comment</b><br>Information about this vnode. This attribute may be set by the manager to any string to inform users of any information relating to the node. If this attribute is not explicitly set, the PBS server will use the attribute to pass information about the node status, specifically why the node is down. If the attribute is explicitly set by the manager, it will not be modified by the server. | <i>String</i><br>Limit: 80 characters  |              |                                | No default | str         | r | r    | r, w |
| <b>current_aoe</b><br>The AOE currently instantiated on this vnode. Case-sensitive. Cannot be set on server's host.  | <i>String</i>  |              |                                | Unset      | str         | r | r    | r, w |
| <b>current_eoe</b><br>Current value of eoe on this vnode. We do not recommend setting this attribute manually.   | <i>String</i>  |              |                                | Unset      | str         | r | r    | r, w |
| <b>in_multivnode_host</b><br>Specifies whether a vnode is part of a multi-vnoded host. Used internally. Do not set.  | <i>Integer</i>   | <i>Unset</i> | Not part of a multi-vnode host |            | int         |   |      | r, w |
|  |  | <i>1</i>     | Part of a multi-vnode host     |            |             |   |      |      |
| <b>jobs</b><br>List of jobs running on this vnode.   | <i>String</i> . Syntax:<br><processor number>/<job ID>,<br>...   |              |                                |            | str         | r | r    | r    |
| <b>last_state_change_time</b><br>Records the most recent time that this node changed state.  | <i>Timestamp</i> .<br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |              |                                | No default | int         | r | r, w | r, w |

| Vnode Attributes  |   |           |                          |  |             |    |      |      |
|---|---|-----------|--------------------------|--|-------------|----|------|------|
| Name<br>Description   | Format  | Val / Opt | Value/Option Description | Def Val                                | Python Type | Us | Opt  | Mgr  |
| <b>last_used_time</b><br>Records the most recent time that this node finished being used for a job or reservation.<br>Set at creation or reboot time. Updated when node is released early from a running job. Reset when node is ramped up.   | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |           |                          | Time of vnode creation or node reboot. | int         | r  | r, w | r, w |
| <b>license</b><br>Indicates whether this vnode is licensed. Set by PBS.   | <i>Character</i>  | <i>/</i>  | This vnode is licensed.  | Unset                                  | str         | r  | r    | r    |
| <b>license_info</b><br>Number of licenses assigned to this vnode. Set by PBS.   | <i>Integer</i>  |           |                          | Unset                                  | int         | r  | r    | r    |
| <b>lictype</b><br>No longer used.   |   |           |                          |  | none        | -  | -    | -    |
| <b>maintenance_jobs</b><br>List of jobs that were running on this vnode, but have been suspended via the <i>admin-suspend</i> signal to <code>qsig</code> . Set by server.  | <i>String_array</i>   |           |                          | No default                             | str         | -  | -    | r    |
| <b>Mom</b><br>Hostname where server queries for MoM host. By default the server queries the canonicalized name of the MoM host, unless you set this attribute when you create the vnode.<br><br>Can be explicitly set by Manager only via <code>qmgr</code> , and only at vnode creation. The server can set this to the FQDN of the host on which MoM runs, if the vnode name is the same as the hostname. | <i>String</i>   |           | .                        | Value of vnode resource (vnode name)   | str         | r  | r    | r, w |
| <b>name</b><br>The name of this vnode.  | <i>String</i>   |           |                          | No default                             | str         | r  | r    | r, w |

| Vnode Attributes   |   |              |  |                            |             |   |      |      |
|--|---|--------------|--|----------------------------|-------------|---|------|------|
| Name<br>Description  | Format  | Val / Opt    | Value/Option Description   | Def Val                    | Python Type | g | o    | Mgr  |
| <b>no_multinode_jobs</b><br>Controls whether jobs which request more than one chunk are allowed to execute on this vnode. Used for cycle harvesting.   | <i>Boolean</i>  |              | When set to <i>True</i> , jobs requesting more than one chunk are not allowed to execute on this vnode | <i>False</i>               | bool        | r | r    | r, w |
| <b>ntype</b><br>The type of this vnode.  | <i>String</i>   | <i>PBS</i>   | Normal vnode   | <i>PBS</i>                 | pbs.ND_PBS  | r | r    | r    |
| <b>partition</b><br>Name of partition to which this vnode is assigned. A vnode can be assigned to at most one partition.   | <i>String</i>   |              |  | No default                 | str         | r | r, w | r, w |
| <b>pbs_version</b><br>The version of PBS for this MoM  | <i>String</i>   |              |  | No default                 | str         | r | r    | r    |
| <b>pcpus</b><br><b>Deprecated.</b><br>The number of physical CPUs on this vnode. This is set to the number of CPUs available when MoM starts. For a multiple-vnode MoM, only the parent vnode has pcpus. | <i>Integer</i>  |              |  | Number of CPUs on start-up | int         | r | r    | r    |
| <b>pnames</b><br>The list of resources being used for placement sets. Not used for scheduling; advisory only.  | <i>String</i> . Syntax: comma-separated list of resource names. |              |  | No default                 | str         | r | r    | r, w |
| <b>Port</b><br>Port number on which MoM daemon listens. Can be explicitly set only via <code>qmgr</code> , and only at vnode creation.   | <i>Integer</i>  |              |  | <i>15002</i>               | int         | - | r, w | r, w |
| <b>poweroff_eligible</b><br>Enables powering this vnode up and down by PBS.  | <i>Boolean</i>  | <i>True</i>  | PBS can power this vnode on and off.   | <i>False</i>               | bool        | r | r    | r, w |
|  |   | <i>False</i> | PBS cannot power this vnode on and off.  |                            |             |   |      |      |
| <b>power_provisioning</b><br>Specifies whether this node is eligible to have its power managed by PBS, including whether it can use power profiles.  | <i>Boolean</i>  | <i>True</i>  | Power provisioning is enabled at this vnode.   | <i>False</i>               | bool        | r | r    | r, w |
|  |   | <i>False</i> | Power provisioning is disabled at this vnode.  |                            |             |   |      |      |

| Vnode Attributes   |   |                                 |  |            |  |    |      |      |
|--|---|---------------------------------|--|------------|--|----|------|------|
| Name<br>Description  | Format  | Val / Opt                       | Value/Option Description   | Def Val    | Python Type  | js | Obj  | Mgr  |
| Priority<br>The priority of this vnode compared with other vnodes.   | Integer   | <i>[-1024, +1023]</i> inclusive |  | No default | int  | r  | r, w | r, w |
| provision_enable<br>Controls whether this vnode can be provisioned. Cannot be set on server's host.  | Boolean   | True                            | This vnode may be provisioned.   | False      | bool   | r  | r    | r, w |
|  |   | False                           | This vnode may not be provisioned.   |            |  |    |      |      |
| queue<br><b>Deprecated.</b> The queue with which this vnode is associated. Each vnode can be associated with at most 1 queue. Queues can be associated with multiple vnodes. Any jobs in a queue that has associated vnodes can run only on those vnodes. If a vnode has an associated queue, only jobs in that queue can run on that vnode. | String  | <name of queue>                 | Only jobs in specified queue may run on this vnode.                              | No default | pbs.queue  | r  | r    | r, w |
|  |   | Unset                           | Any job in any queue that does not have associated vnodes can run on this vnode. |            |  |    |      |      |
| resources_assigned<br>The total amount of each resource allocated to running and exiting jobs and started reservations on this vnode.  | String. Syntax:<br><i>resources_assigned.&lt;resource name&gt;=&lt;value&gt;</i><br><i>[,resources_assigned.&lt;resource name&gt;=&lt;value&gt;</i>           |                                 |  | No default | <b>pbs.pbs_resource</b><br>Syntax:<br><i>resources_assigned['&lt;resource name&gt;'] = &lt;val&gt;</i><br>where <i>resource name</i> is any built-in or custom resource  | r  | r    | r    |
| resources_available<br>The list of resources and the amounts available on this vnode. If not explicitly set, the amount shown is that reported by the <code>pbs_mom</code> running on this vnode. If a resource value is explicitly set, that value is retained across restarts.   | String. Syntax:<br><i>resources_available.&lt;resource name&gt;=&lt;value&gt;</i><br>, <i>resources_available.&lt;resource name&gt; = &lt;value&gt;</i> , ... |                                 |  | No default | <b>pbs.pbs_resource</b><br>Syntax:<br><i>resources_available['&lt;resource name&gt;'] = &lt;val&gt;</i><br>where <i>resource name</i> is any built-in or custom resource | r  | r, w | r, w |

| Vnode Attributes   |   |                         |  |                       |                         |           |                        |         |
|--|---|-------------------------|--|-----------------------|-------------------------|-----------|------------------------|---------|
| Name<br>Description  | Format  | Val / Opt               | Value/Option Description   | Def Val               | Python Type             | Is<br>Set | Can<br>Be<br>Overriden | Managed |
| <b>resv</b><br>List of advance and standing reservations pending on this vnode.  | <i>String</i> .<br>Comma-separated list of reservation IDs.<br>Syntax:<br><reservation ID>[, <reservation ID>, ...] |                         |  | No default            | str                     | r         | r                      | r       |
| <b>resv_enable</b><br>Controls whether the vnode can be used for advance and standing reservations. Reservations are incompatible with cycle harvesting.   | <i>Boolean</i>  |                         | When set to <i>True</i> , this vnode can be used for reservations. Existing reservations are honored when this attribute is changed from <i>True</i> to <i>False</i> . | <i>True</i>           | bool                    | r         | r                      | r, w    |
| <b>sharing</b><br>Specifies whether more than one job at a time can use the resources of the vnode or the vnode's host. Either (1) the vnode or host is allocated exclusively to one job, or (2) the vnode's or host's unused resources are available to other jobs. Can be set in the cgroups configuration file or by using <code>pbs_mom -s insert</code> . Behavior of a vnode or host is determined by a combination of the <b>sharing</b> attribute and a job's placement directive, defined as follows: | <i>String</i> . Example: <code>vnodename: sharing=force_excl</code>   | <i>default_shared</i>   | Defaults to <i>shared</i>  | <i>default_shared</i> | pbs.ND_DEFAULT_SHARED   | r         | r, w                   | r, w    |
|  |   | <i>default_excl</i>     | Defaults to <i>exclusive</i>   |                       | pbs.ND_DEFAULT_EXCL     |           |                        |         |
|  |   | <i>default_exclhost</i> | Entire host is assigned to the job unless the job's sharing request specifies otherwise  |                       | pbs.ND_DEFAULT_EXCLHOST |           |                        |         |
|  |   | <i>ignore_excl</i>      | Overrides any job <i>place=excl</i> setting  |                       | pbs.ND_IGNORE_EXCL      |           |                        |         |
|  |   | <i>force_excl</i>       | Overrides any job <i>place=shared</i> setting  |                       | pbs.ND_FORCE_EXCL       |           |                        |         |
|  |   | <i>force_exclhost</i>   | The entire host is assigned to the job, regardless of the job's sharing request  |                       | pbs.ND_FORCE_EXCLHOST   |           |                        |         |
|  |   | Unset                   | Defaults to <i>shared</i>  |                       |                         |           |                        |         |

| Vnode Attributes    |                         |                              |                          |                    |                        |                         |             |                   |
|---------------------|-------------------------|------------------------------|--------------------------|--------------------|------------------------|-------------------------|-------------|-------------------|
| Name<br>Description | Format                  | Val / Opt                    | Value/Option Description |                    |                        | Def Val                 | Python Type | Usr<br>Opt<br>Mgr |
|                     | Behavior of vnode:      |                              |                          |                    |                        |                         |             |                   |
|                     | Value of sharing        | Placement Request (-lplace=) |                          |                    |                        |                         |             |                   |
|                     |                         | Vnode                        |                          |                    | Host                   |                         |             |                   |
|                     |                         | not specified                | place= <i>shared</i>     | place= <i>excl</i> | place= <i>exclhost</i> | place! <i>=exclhost</i> |             |                   |
|                     | not set                 | shared                       | shared                   | exclusive          | exclusive              | depends on place        |             |                   |
|                     | <i>default_shared</i>   | shared                       | shared                   | exclusive          | exclusive              | depends on place        |             |                   |
|                     | <i>default_excl</i>     | exclusive                    | shared                   | exclusive          | exclusive              | depends on place        |             |                   |
|                     | <i>default_exclhost</i> | exclusive                    | shared                   | exclusive          | exclusive              | depends on place        |             |                   |
|                     | <i>ignore_excl</i>      | shared                       | shared                   | shared             | shared                 | not exclusive           |             |                   |
|                     | <i>force_excl</i>       | exclusive                    | exclusive                | exclusive          | exclusive              | not exclusive           |             |                   |
|                     | <i>force_exclhost</i>   | exclusive                    | exclusive                | exclusive          | exclusive              | exclusive               |             |                   |

| Vnode Attributes   |  |                          |  |            |             |           |           |                 |
|--|--|--------------------------|--|------------|-------------|-----------|-----------|-----------------|
| Name<br>Description  | Format   | Val / Opt                | Value/Option Description   | Def Val    | Python Type | Is<br>Def | Is<br>Opt | Is<br>Mandatory |
| state<br>Shows or sets the state of the vnode.   | String.<br>Comma-separated list of one or more states:<br><state>[,<br><state>, ...] | <i>busy</i>              | Vnode is reporting load average greater than allowed max. Can combine with <i>offline</i> .  | No default | int         | r         | r         | r               |
|  |  | <i>down</i>              | Node is not responding to queries from the server. Cannot be combined with <i>free</i> , <i>provisioning</i>   |            |             | r         | r         | r               |
|  |  | <i>free</i>              | Vnode is up and capable of accepting new job(s). Cannot be combined with other states.   |            |             | r         | r         | r               |
|  |  | <i>job-busy</i>          | All CPUs on the vnode are allocated to jobs. Can combine with: <i>offline</i> , <i>resv_exclusive</i> .  |            |             | r         | r         | r               |
|  |  | <i>job-exclusive</i>     | Entire vnode is exclusively allocated to one job at the job's request. Can combine with <i>offline</i> , <i>resv_exclusive</i>   |            |             | r         | r         | r               |
|  |  | <i>offline</i>           | Jobs are not to be assigned to this vnode. Can combine: <i>busy</i> , <i>job-busy</i> , <i>job-exclusive</i> , <i>resv_exclusive</i> .   |            |             | r         | r, w      | r, w            |
|  |  | <i>provisioning</i>      | Vnode is being provisioned. Cannot be combined with any other states.  |            |             | r         | r         | r               |
|  |  | <i>resv-exclusive</i>    | Running reservation has requested exclusive use of vnode. Can combine with <i>job-exclusive</i> , <i>offline</i>   |            |             | r         | r         | r               |
|  |  | <i>stale</i>             | Vnode was previously reported to server, but is no longer reported to server. Cannot combine with <i>free</i> , <i>provisioning</i>  |            |             | r         | r         | r               |
|  |  | <i>state-unknown</i>     | The server has never been able to contact the vnode. Either MoM is not running on the vnode, the vnode hardware is down, or there is a network problem.                          |            |             | r         | r         | r               |
|  |  | <i>unresolvable</i>      | The server cannot resolve the name of the vnode.   |            |             | r         | r         | r               |
|  |  | <i>wait-provisioning</i> | Vnode needs to be provisioned, but can't; limit reached for concurrent provisioning vnodes. Cannot be combined with other states. See <a href="#">max_concurrent_provision</a> . |            |             | r         | r         | r               |
| topology_info<br>Contains information intended to be used in hooks. Visible in and usable by hooks only. | XML string   |                          |  | Unset      | str         | -         | -         | -               |

## 6.11 Job Attributes

| Job Attributes   |  |                            |  |                          |             |         |         |         |  |
|--|--|----------------------------|--|--------------------------|-------------|---------|---------|---------|--|
| Name<br>Description  | Format                                     | Val / Opt                  | Value/Option Description   | Def Val                  | Python Type | Us      | Op      | Mgt     |  |
| <b>Account_Name</b><br>String used for accounting purposes. Can be used for fairshare.   | <i>String</i> . Can contain any character. |                            |  | No default               | str         | r,<br>w | r,<br>w | r,<br>w |  |
| <b>accounting_id</b><br>Accounting ID for tracking accounting data not produced by PBS.  | <i>String</i>                              |                            |  | No default               | str         | r       | r       | r       |  |
| <b>accrue_type</b><br>Indicates what kind of time the job is accruing.   | <i>Integer</i>                             | <i>0 (initial_time)</i>    | Job is accruing initial time. Can occur when job is blocked by a <code>runjob</code> hook. | <i>2 (eligible_time)</i> | int         | -       | -       | r       |  |
|  |  | <i>1 (ineligible_time)</i> | Job is accruing ineligible time. Occurs when job or owner has hit limit.                   |                          |             |         |         |         |  |
|  |  | <i>2 (eligible_time)</i>   | Job is accruing eligible time. Occurs when job is blocked on resources.                    |                          |             |         |         |         |  |
|  |  | <i>3 (run_time)</i>        | Job is accruing run time. Occurs when job is running.                                      |                          |             |         |         |         |  |
| <b>alt_id</b><br>For a few systems, the session ID is insufficient to track which processes belong to the job. Where a different identifier is required, it is recorded in this attribute. If set, it is also recorded in the end-of-job accounting record.<br>On Windows, holds PBS home directory. | <i>String</i> . May contain white spaces.  |                            |  | No default               | str         | r       | r       | r       |  |



| Job Attributes  |  |           |   |              |             |      |      |      |
|---|--|-----------|---|--------------|-------------|------|------|------|
| Name<br>Description   | Format   | Val / Opt | Value/Option Description                    | Def Val      | Python Type | g    | h    | Mo   |
| <b>argument_list</b><br>Job executable's argument list. Shown if job is submitted with "-- <executable> [<argument list>]"  | <i>JSDL-encoded string.</i><br><jsdl-hpcpa:Argument> <1st arg><br></jsdl-hpcpa:Argument><br><jsdl-hpcpa:Argument> <2nd arg><br></jsdl-hpcpa:Argument><br><jsdl-hpcpa:Argument> <nth arg><br></jsdl-hpcpa:Argument><br>Example: if arguments are "A B":<br><jsdl-hpcpa:Argument>A</jsdl-hpcpa:Argument><br><jsdl-hpcpa:Argument>B</jsdl-hpcpa:Argument> |           |   | No default   | str         | r, w | r, w | r, w |
| <b>array</b><br>Indicates whether this is a job array.  | <i>Boolean</i>   |           | Set to <i>True</i> if this is an array job. | <i>False</i> | bool        | r, s | r    | r    |
| <b>array_id</b><br>Applies only to subjobs. Array identifier of subjob.   | <i>String</i>  |           |   | No default   | str         | r    | r    | r    |
| <b>array_index</b><br>Applies only to subjobs. Index number of subjob.  | <i>String</i>  |           |   | No default   | int         | r    | r    | r    |
| <b>array_indices_remaining</b><br>Applies only to job arrays. List of indices of subjobs still queued.                      | <i>String.</i> Range or list of ranges, e.g. 500, 552, 596–1000.   |           |   | No default   | str         | r    | r    | r    |
| <b>array_indices_submitted</b><br>Applies only to job arrays. Complete list of indices of subjobs given at submission time. | <i>String.</i> Given as range, e.g. 1–100  |           |   | No default   | pbs.range   | r, s | r    | r    |

| Job Attributes  |                |                           |   |              |                 |         |         |         |
|---|----------------|---------------------------|---|--------------|-----------------|---------|---------|---------|
| Name<br>Description   | Format         | Val / Opt                 | Value/Option Description  | Def Val      | Python Type     | Sub     | Opt     | Mod     |
| array_state_count<br>Applies only to job arrays. Lists number of subjobs in each state.   | <i>String</i>  |                           |   | No default   | pbs.state_count | r       | r       | r       |
| block<br>Specifies whether qsub will wait for the job to complete and return the exit value of the job.<br>For X11 forwarding jobs, and jobs with <b>interactive</b> and/or <b>block</b> attributes set to <i>True</i> , the job's exit status is not returned. | <i>Boolean</i> |                           |   | <i>False</i> | int             | r,<br>s | r       | r       |
| Checkpoint<br>Determines when the job will be checkpointed. An \$action script is required to checkpoint the job.   | <i>String</i>  | c                         | Checkpoint at intervals, measured in CPU time, set on job's execution queue. If no interval set at queue, job is not checkpointed.  | <i>u</i>     | pbs.checkpoint  | r,<br>w | r,<br>w | r,<br>w |
|   |                | c = <minutes of CPU time> | Checkpoint at intervals of specified number of minutes of job CPU time. This value must be > 0. If interval specified is less than that set on job's execution queue, queue's interval is used.<br>Format: <i>Integer</i>                           |              |                 |         |         |         |
|   |                | w                         | Checkpoint at intervals, measured in walltime, set on job's execution queue. If no interval set at queue, job is not checkpointed.  |              |                 |         |         |         |
|   |                | w = <minutes of walltime> | Checkpoint at intervals of the specified number of minutes of job walltime. This value must be greater than zero. If the interval specified is less than that set on job's execution queue, the queue's interval is used.<br>Format: <i>Integer</i> |              |                 |         |         |         |
|   |                | n                         | No checkpointing.   |              |                 |         |         |         |
|   |                | s                         | Checkpoint only when the server is shut down.   |              |                 |         |         |         |
|   |                | u                         | Unset. Defaults to behavior when <i>interval</i> argument is set to <i>s</i> .  |              |                 |         |         |         |

| Job Attributes  |   |              |   |              |             |      |      |      |
|---|---|--------------|---|--------------|-------------|------|------|------|
| Name<br>Description   | Format  | Val / Opt    | Value/Option Description                    | Def Val      | Python Type | r    | w    | r, w |
| <b>comment</b><br>Comment about job. Informational only.  | <i>String</i>   |              |   | No default   | str         | r    | r, w | r, w |
| <b>create_resv_from_job</b><br>When this job is run, immediately creates and confirms a <i>job-specific start reservation</i> on the same resources as the job (including resources inherited by the job), and places the job in the job-specific reservation's queue. Sets the job's <b>create_resv_from_job</b> attribute to <i>True</i> . Sets the job-specific reservation's <b>reserve_job</b> attribute to the ID of the job from which the reservation was created. The new reservation's duration and start time are the same as the job's walltime and start time. If the job is peer scheduled, the job-specific reservation is created in the pulling complex. | <i>Boolean</i>  | <i>False</i> | Does not create a reservation.              | <i>False</i> | bool        | r, w | r, w | r, w |
|   |   | <i>True</i>  | Creates the job-specific start reservation. |              |             |      |      |      |
| <b>ctime</b><br>Timestamp; time at which the job was created.   | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |              |   | No default   | int         | r    | r    | r    |

| Job Attributes   |   |                            |   |                             |             |      |      |      |
|--|---|----------------------------|---|-----------------------------|-------------|------|------|------|
| Name<br>Description  | Format  | Val / Opt                  | Value/Option Description  | Def Val                     | Python Type | g    | O    | M    |
| <b>depend</b><br>Specifies inter-job dependencies.<br>No limit on number of dependencies.                        | <b>String.</b> Syntax:<br><code>&lt;type&gt;:&lt;job ID&gt;[:&lt;job ID&gt; ...], [&lt;type&gt;:&lt;job ID&gt;[:&lt;job ID&gt; ...] ...]</code><br>Must be enclosed in double quotes if it contains commas. Example:<br><code>"before:123:456"</code> | after:<job ID list>        | This job may run at any point after all jobs in <i>job ID list</i> have started execution.  | No default; no dependencies | pbs.depend  | r, w | r, w | r, w |
|  |   | afterok:<job ID list>      | This job may run only after all jobs in <i>job ID list</i> have terminated with no errors.  |                             |             |      |      |      |
|  |   | afterno-tok:<job ID list>  | This job may run only after all jobs in <i>job ID list</i> have terminated with errors.   |                             |             |      |      |      |
|  |   | after-any:<job ID list>    | This job can run after all jobs in <i>job ID list</i> have finished execution, with or without errors. This job will not run if a job in the <i>job ID list</i> was deleted without ever having been run. |                             |             |      |      |      |
|  |   | before:<job ID list>       | Jobs in <i>job ID list</i> may start once this job has started.   |                             |             |      |      |      |
|  |   | beforeok:<job ID list>     | Jobs in <i>job ID list</i> may start once this job terminates without errors.   |                             |             |      |      |      |
|  |   | beforeno-tok:<job ID list> | If this job terminates execution with errors, jobs in <i>job ID list</i> may begin.   |                             |             |      |      |      |
|  |   | before-any:<job ID list>   | Jobs in <i>job ID list</i> may begin execution once this job terminates execution, with or without errors.  |                             |             |      |      |      |
|  |   | on:<count>                 | This job may run after <i>count</i> dependencies on other jobs have been satisfied. This type is used with one of the <i>before</i> types listed. <i>Count</i> is an integer greater than 0.              |                             |             |      |      |      |
| <b>egroup</b><br>If the job is queued, this attribute is set to the group name under which the job is to be run. | <i>String</i>   |                            |   | No default                  | str         | -    | -    | r    |

| Job Attributes  |  |  |   |  |                           |                |                |                |
|---|--|--|---|--|---------------------------|----------------|----------------|----------------|
| Name<br>Description   | Format   | Val / Opt                                      | Value/Option Description  | Def Val  | Python Type               | $\mathfrak{D}$ | $\mathfrak{O}$ | $\mathfrak{M}$ |
| <b>eligible_time</b><br>The amount of wall clock wait time a job has accrued while the job is blocked waiting for resources. For a job currently accruing <i>eligible_time</i> , if we were to add enough of the right type of resources, the job would start immediately. Viewable via <code>qstat -f</code> . | <i>Duration</i>  |  |   | <i>Zero</i>  | <code>pbs.duration</code> | r              | r, w           | r, w           |
| <b>Error_Path</b><br>The final path name for the file containing the job's standard error stream. See the <a href="#">qsub</a> and <a href="#">qalter</a> commands.   | <i>String</i> . Syntax: <i>[&lt;hostname&gt;:]&lt;path&gt;</i> | <i>&lt;relative path&gt;</i>                   | Path is relative to the current working directory of command executing on current host. | Default path is current working directory where <code>qsub</code> is run.  | <b>str</b>                | r, w           | r, w           | r, w           |
|   |  | <i>&lt;absolute path&gt;</i>                   | Path is absolute path on current host where command is executing.                       | If the output path is specified, but does not include a filename, the default filename is <i>&lt;job ID&gt;.ER</i> . If the path name is not specified, the default filename is <i>&lt;job name&gt;.e&lt;sequence number&gt;</i> . |                           |                |                |                |
|   |  | <i>&lt;host-name&gt;:&lt;relative path&gt;</i> | Path is relative to user's home directory on specified host.                            |  |                           |                |                |                |
|   |  | <i>&lt;host-name&gt;:&lt;absolute path&gt;</i> | Path is absolute path on named host.  |  |                           |                |                |                |
|   |  | No path  | Path is current working directory where <code>qsub</code> is executed.                  |  |                           |                |                |                |

| Job Attributes  |   |                      |  |            |   |          |          |          |
|---|---|----------------------|--|------------|---|----------|----------|----------|
| Name<br>Description   | Format  | Val / Opt            | Value/Option Description   | Def Val    | Python Type   | <b>S</b> | <b>O</b> | <b>M</b> |
| <b>estimated</b><br>List of estimated values for job.<br>Used to report job's <code>exec_vnode</code> , <code>start_time</code> , and <code>soft_walltime</code> . Can be set in a hook or via <code>qalter</code> , but PBS will overwrite the values. | Syntax: <i>estimated.&lt;resource name&gt;=&lt;value&gt;</i> , <i>estimated.&lt;resource name&gt;=&lt;value&gt;</i> .<br><i>exec_vnode</i> is a <i>string</i> .<br><i>soft_walltime</i> is a <i>duration</i> .<br><i>start_time</i> is printed by <code>qstat</code> in human-readable <i>Date</i> format; <i>start_time</i> is output in hooks as seconds since epoch. | <i>exec_vnode</i>    | The estimated vnodes used by this job.   | Unset      | <code>pbs.pbs_resource</code>   | r        | r, w     | r, w     |
|   |   | <i>soft_walltime</i> | The estimated soft walltime for this job. Calculated when a job exceeds its <code>soft_walltime</code> resource. | Unset      | Syntax: <i>estimated.[&lt;resource name&gt;]=&lt;value&gt;</i>  | r        | r        | r, w     |
|   |   | <i>start_time</i>    | The estimated start time for this job.   | Unset      | .<br><i>exec_vnode</i> is a <i>pbs.exec_vnode</i> .<br>.<br><i>soft_walltime</i> is a <i>duration</i> .<br><i>start_time</i> is an <i>int</i> . | r        | r, w     | r, w     |
| <b>etime</b><br>Timestamp; time when job became eligible to run, i.e. was enqueued in an execution queue and was in the "Q" state. Reset when a job moves queues, or is held then released. Not affected by <code>qalter</code> .                       | <b>Timestamp.</b><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.   |                      |  | No default | <code>int</code>  | r        | r        | r        |
| <b>euser</b><br>If the job is queued, this attribute is set to the user name under which the job is to be run.  | <i>String</i>   |                      |  | No default | <code>str</code>  | -        | -        | r        |
| <b>executable</b><br>JSDL-encoded listing of job's executable. Shown if job is submitted with " <code>-- &lt;executable&gt; [&lt;arg list&gt;]</code> ".  | <b>JSDL-encoded string.</b><br><code>&lt;jSDL-hpcpa:Executable&gt; &lt;name of executable&gt;</code><br>Example: if the executable is <code>ping</code> :<br><code>&lt;jSDL-hpcpa:Executable&gt;ping&lt;/jSDL-hpcpa:Executable&gt;</code>   |                      |  | No default | <code>str</code>  | r, w     | r, w     | r, w     |

| Job Attributes  |   |           |                          |                 |                |               |                 |                   |
|---|---|-----------|--------------------------|-----------------|----------------|---------------|-----------------|-------------------|
| Name<br>Description   | Format  | Val / Opt | Value/Option Description | Def Val         | Python Type    | Job<br>Status | Queue<br>Status | Monitor<br>Status |
| <b>Execution_Time</b><br>Timestamp; time after which the job may execute. Before this time, the job remains queued in the (W)ait state.<br>Can be set when stage-in fails and PBS moves job start time out 30 minutes to allow user to fix problem.   | <i>Datetime</i> . See <a href="#">Chapter 7, "Formats", on page 357</a> .   |           |                          | Unset; no delay | int            | r, w          | r, w            | r, w              |
| <b>exec_host</b><br>If the job is running, this is set to the name of the host or hosts on which the job is executing.  | <i>String</i> . Syntax: <i>&lt;host-name&gt;/N[*C][+...]</i> , where <i>N</i> is task slot number starting at 0, on that host, and <i>C</i> is the number of CPUs allocated to the job. <i>*C</i> does not appear if its value is 1.  |           |                          | No default      | pbs.exec_host  | r             | r, i            | r, i              |
| <b>exec_vnode</b><br>List of chunks for the job. Each chunk shows the name of the vnode(s) from which it is taken, along with the host-level, consumable resources allocated from that vnode, and any AOE provisioned on this vnode for this job.<br>If a vnode is allocated to the job but no resources from the vnode are used by the job, the vnode name appears alone.<br>If a chunk is split across vnodes, the name of each vnode and its resources appear inside one pair of parentheses, joined with a plus "+" sign. | Each chunk is enclosed in parentheses. Chunks are connected by plus signs. Example: For a job which requested two chunks satisfied by resources from three vnodes, exec_vnode is: (vnodeA:ncpus=N:mem=X)+(nodeB:ncpus=P:mem=Y+nodeC:mem=Z).<br>For a job which requested one chunk and exclusive use of a 2-vnode host, where the chunk was satisfied by resources from one vnode, exec_vnode is (vnodeA:ncpus=N:mem=X)+(vnodeB). |           |                          | No default      | pbs.exec_vnode | r             | r, w            | r, w              |

| Job Attributes   |   |           |                          |            |                |                |                |                |
|--|---|-----------|--------------------------|------------|----------------|----------------|----------------|----------------|
| Name<br>Description  | Format  | Val / Opt | Value/Option Description | Def Val    | Python Type    | $\mathfrak{S}$ | $\mathfrak{O}$ | $\mathfrak{M}$ |
| <b>Exit_status</b><br>Exit status of job. Set to zero for successful execution. If any subjob of an array job has non-zero exit status, the array job has non-zero exit status.  | <i>Integer</i>  |           |                          | No default | int            | r              | r              | r              |
| <b>forward_x11_cookie</b><br>Contains the X authorization cookie.  | <i>String</i>   |           |                          | No default | str            | r              | r              | r              |
| <b>forward_x11_port</b><br>Contains the number of the port being listened to by the port forwarder on the submission host.   | <i>Integer</i>  |           |                          | No default | int            | r              | r              | r              |
| <b>group_list</b><br>A list of group names used to determine the group under which the job runs. When a job runs, the server selects a group name from the list according to the following ordered set of rules:<br>1. Select the group name for which the associated host name matches the name of the server host.<br>2. Select the group name which has no associated host name.<br>3. Use the login group for the user name under which the job will be run. | <i>String</i> . Syntax:<br><group name>[@<host-name>][,<group name>[@<host-name>]...]<br>Must be enclosed in double quotes if it contains commas. |           |                          | No default | pbs.group_list | r,<br>w        | r,<br>w        | r,<br>w        |
| <b>hashname</b><br>No longer used.   |   |           |                          |            |                | -              | -              | -              |
| <b>Hold_Types</b><br>The set of holds currently applied to the job. If the set is not null, the job will not be scheduled for execution and is said to be in the <i>held</i> state. The <i>held</i> state takes precedence over the <i>wait</i> state.   | <i>String</i> , made up of the letters 'n', 'o', 'p', 's', 'u'  | <i>n</i>  | No hold                  | <i>n</i>   | pbs.hold_types | r,<br>w        | r,<br>w        | r,<br>w        |
|  |   | <i>o</i>  | Other hold               |            |                |                |                |                |
|  |   | <i>p</i>  | Bad password             |            |                |                |                |                |
|  |   | <i>s</i>  | System hold              |            |                |                |                |                |
|  |   | <i>u</i>  | User hold                |            |                |                |                |                |



| Job Attributes   |   |           |   |                                   |             |                                      |                                      |                                      |
|--|---|-----------|---|-----------------------------------|-------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Name<br>Description  | Format  | Val / Opt | Value/Option Description                          | Def Val                           | Python Type | <small>g</small><br><small>u</small> | <small>b</small><br><small>O</small> | <small>b</small><br><small>M</small> |
| <b>interactive</b><br>Specifies whether the job is interactive.<br>Can be set, but not altered, by unprivileged user.<br>When both this attribute and the <b>block</b> attribute are <i>True</i> , no exit status is returned.<br>For X11 forwarding jobs, the job's exit status is not returned.<br>Cannot be set using a PBS directive.<br>Job arrays cannot be interactive. | <i>Boolean</i>  |           | Set to <i>True</i> if this is an interactive job. | <i>False</i>                      | int         | r,<br>w                              | r                                    | r                                    |
| <b>jobdir</b><br>Path of the job's staging and execution directory on the primary execution host. Either user's home, or private sandbox. Depends on value of <b>sandbox</b> attribute. Viewable via <code>qstat -f</code> .   | <i>String</i>   |           |   | No default                        | str         | r                                    | r                                    | r                                    |
| <b>Job_Name</b><br>The job name. See the <code>qalter</code> and <code>qsub</code> commands.   | <i>String</i> . See " <a href="#">Job Name, Job Array Name</a> " on page 359  |           |   | Base name of job script, or STDIN | str         | r,<br>w                              | r,<br>w                              | r,<br>w                              |
| <b>Job_Owner</b><br>The login name on the submitting host of the user who submitted the batch job.   | <i>String</i> . Syntax: <code>&lt;Username&gt;@&lt;submission host&gt;</code> |           |   | No default                        | str         | r                                    | r                                    | r                                    |

## Attributes

| Job Attributes                     |                  |                           |  |            |                                  |                |                |
|------------------------------------|------------------|---------------------------|--|------------|----------------------------------|----------------|----------------|
| Name<br>Description                | Format           | Val / Opt                 | Value/Option Description   | Def Val    | Python Type                      | $\mathfrak{b}$ | $\mathfrak{O}$ |
| job_state<br>The state of the job. | <i>Character</i> | <i>B (Begun)</i>          | Job arrays only. Job array has begun execution.  | No default | pbs.JOB_STATE_BEGUN              | r,             | r,             |
|                                    |                  | <i>E (Exiting)</i>        | The job has finished, with or without errors, and PBS is cleaning up post-execution.   |            | pbs.JOB_STATE_EXITING            | i              | i              |
|                                    |                  | <i>F (Finished)</i>       | Job is finished. Job has completed execution, job failed during execution, or job was deleted.   |            | pbs.JOB_STATE_FINISHED           |                |                |
|                                    |                  | <i>H (Held)</i>           | The job is held.   |            | pbs.JOB_STATE_HELD               |                |                |
|                                    |                  | <i>M (Moved)</i>          | The job has been moved to another server.  |            | pbs.JOB_STATE_MOVED              |                |                |
|                                    |                  | <i>Q (Queued)</i>         | The job resides in an execution or routing queue pending execution or routing. It is not in held or waiting state.   |            | pbs.JOB_STATE_QUEUED             |                |                |
|                                    |                  | <i>R (Running)</i>        | The job is in an execution queue and is running.   |            | pbs.JOB_STATE_RUNNING            |                |                |
|                                    |                  | <i>S (Suspended)</i>      | The job was executing and has been suspended. The job does not use CPU cycles or walltime.   |            | pbs.JOB_STATE_SUSPEND            |                |                |
|                                    |                  | <i>T (Transiting)</i>     | The job is being routed or moved to a new destination.   |            | pbs.JOB_STATE_TRANSIT            |                |                |
|                                    |                  | <i>U (User suspended)</i> | The job was running on a workstation configured for cycle harvesting and the keyboard/mouse is currently busy. The job is suspended until the workstation has been idle for a configured amount of time. |            | pbs.JOB_STATE_SUSPEND_USERACTIVE |                |                |
|                                    |                  | <i>W (Waiting)</i>        | The Execution_Time attribute contains a time in the future. Can be set when stage-in fails and PBS moves job start time out 30 minutes to allow user to fix problem.                                     |            | pbs.JOB_STATE_WAITING            |                |                |
|                                    |                  | <i>X (Expired)</i>        | Subjobs only. Subjob is finished (expired.)  |            | pbs.JOB_STATE_EXPIRED            |                |                |

| Job Attributes   |   |           |   |                |                 |               |               |               |
|--|---|-----------|---|----------------|-----------------|---------------|---------------|---------------|
| Name<br>Description  | Format  | Val / Opt | Value/Option Description  | Def Val        | Python Type     | $\mathcal{R}$ | $\mathcal{W}$ | $\mathcal{M}$ |
| Join_Path<br>Specifies whether the job's standard error and standard output streams are to be merged and placed in the file specified in the Output_Path job attribute.  | <i>String</i><br>One of "oe", "eo", or "n".   | eo        | Standard output and standard error are merged, intermixed, into a single stream, which becomes standard error.  | n              | pbs.join_path   | r,            | r,            | r,            |
|  |   | oe        | Standard output and standard error are merged, intermixed, into a single stream, which becomes standard output. |                |                 | w             | w             | w             |
|  |   | n         | Standard output and standard error are not merged.  |                |                 |               |               |               |
| Keep_Files<br>Specifies whether the standard output and/or standard error streams are retained on the execution host in the job's staging and execution directory after the job has executed. Otherwise these files are returned to the submission host. Keep_Files overrides the Output_Path and Error_Path attributes. | <i>String</i><br>One of "o", "e", "oe", "eo", or "n".   | o         | The standard output stream is retained. The filename is:<br><job name>.o<sequence number>                       | n              | pbs.keep_files  | r,            | r,            | r,            |
|  |   | e         | The standard error stream is retained. The filename is:<br><job name>.e<sequence number>                        |                |                 | w             | w             | w             |
|  |   | eo, oe    | Both standard output and standard error streams are retained.   |                |                 |               |               |               |
|  |   | d         | Output and error are written directly to their final destination  |                |                 |               |               |               |
|  |   | n         | Neither stream is retained. Files are returned to submission host.  |                |                 |               |               |               |
| Mail_Points<br>Specifies state changes for which the server sends mail about the job.  | <i>String</i><br>Can be any of "a", "b", "e", with optional "j", or "n".  | a         | Mail is sent when job is aborted  | a              | pbs.mail_points | r,            | r,            | r,            |
|  |   | b         | Mail is sent at beginning of job  |                |                 | w             | w             | w             |
|  |   | e         | Mail is sent at end of job  |                |                 |               |               |               |
|  |   | j         | Mail is sent for subjobs. Must be combined with one or more of a, b, and e options                              |                |                 |               |               |               |
|  |   | n         | No mail is sent. Cannot be combined with other options.   |                |                 |               |               |               |
| Mail_Users<br>The set of users to whom mail is sent when the job makes state changes specified in the Mail_Points job attribute.   | <i>String</i><br>Syntax: "<user-name>@<host-name>[,<username>@<hostname>]" Must be enclosed in double quotes if it contains commas. |           |   | Job owner only | pbs.email_list  | r,            | r,            | r,            |
|  |   |           |   |                |                 | w             | w             | w             |

| Job Attributes  |   |           |                          |            |             |      |      |      |
|---|---|-----------|--------------------------|------------|-------------|------|------|------|
| Name<br>Description   | Format  | Val / Opt | Value/Option Description | Def Val    | Python Type | Sub  | Ob   | Msg  |
| <b>max_run_subjobs</b><br>Sets a limit on the number of subjobs that can be running at one time.<br>Can be set using <code>qsub -J &lt;range&gt; [%&lt;max_subjobs&gt;]</code> or <code>qalter -Wmax_run_subjobs=&lt;new value&gt; &lt;job ID&gt;</code> .<br>Suspended subjobs are not counted against this limit. | <i>Integer</i>  |           |                          | No default | int         | r, w | r, w | r, w |
| <b>mtime</b><br>Timestamp; the time that the job was last modified, changed state, or changed locations.  | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |           |                          | No default | int         | r    | r    | r    |
| <b>no_stdio_sockets</b><br>Not used.  |   |           |                          |            |             | -    | -    | -    |
| <b>obittime</b><br>Time when job or subjob obit was sent  | <i>Integer</i><br><i>Seconds since epoch</i>  |           |                          | No default | int         | r    | r    | r    |

| Job Attributes   |   |  |   |   |             |                |                |                |
|--|---|--|---|---|-------------|----------------|----------------|----------------|
| Name<br>Description  | Format  | Val / Opt  | Value/Option Description  | Def Val   | Python Type | $\mathfrak{S}$ | $\mathfrak{O}$ | $\mathfrak{M}$ |
| <b>Output_Path</b><br>The final path name for the file containing the job's standard output stream. See the <code>qsub</code> and <code>qalter</code> commands.                                    | <i>String</i> . Syntax:<br><code>[&lt;hostname&gt;:]&lt;path&gt;</code> | <code>&lt;relative path&gt;</code>                   | Path is relative to the current working directory of command executing on current host. | Default path is current working directory where <code>qsub</code> is run.<br>If the output path is specified, but does not include a filename, the default filename is <code>&lt;job ID&gt;.OU</code> . If the path name is not specified, the default filename is <code>&lt;job name&gt;.o&lt;sequence number&gt;</code> . | str         | r, w           | r, w           | r, w           |
|  |   | <code>&lt;absolute path&gt;</code>                   | Path is absolute path on current host where command is executing.                       |   |             |                |                |                |
|  |   | <code>&lt;host-name&gt;:&lt;relative path&gt;</code> | Path is relative to user's home directory on specified host.                            |   |             |                |                |                |
|  |   | <code>&lt;host-name&gt;:&lt;absolute path&gt;</code> | Path is absolute path on named host.  |   |             |                |                |                |
|  |   | No path  | Path is current working directory where <code>qsub</code> is executed.                  |   |             |                |                |                |
| <b>pcap_accelerator</b><br>Power attribute. Power cap for an accelerator. Corresponds to Cray <code>capmc set_power_cap --accel</code> setting. See <code>capmc</code> documentation.              | <i>Integer</i><br>Units: <i>Watts</i>                                   |  |   | Unset   | int         | r, w           | r, w           | r, w           |
| <b>pcap_node</b><br>Power attribute. Power cap for a node. Corresponds to Cray <code>capmc set_power_cap --node</code> setting. See <code>capmc</code> documentation.                              | <i>Integer</i><br>Units: <i>Watts</i>                                   |  |   | Unset   | int         | r, w           | r, w           | r, w           |
| <b>pgov</b><br>Power attribute. Cray ALPS reservation setting for CPU throttling corresponding to <code>p-governor</code> . See BASIL 1.4 documentation. We do not recommend using this attribute. | <i>String</i>   |  |   | Unset   | str         | r, w           | r, w           | r, w           |




| Job Attributes   |   |                            |                          |                                   |                        |                |                |                |
|--|---|----------------------------|--------------------------|-----------------------------------|------------------------|----------------|----------------|----------------|
| Name<br>Description  | Format  | Val / Opt                  | Value/Option Description | Def Val                           | Python Type            | $\mathfrak{S}$ | $\mathfrak{O}$ | $\mathfrak{M}$ |
| <b>Priority</b><br>Used as an input when computing scheduling priority for the job. Higher value indicates greater priority. This attribute can set by the job submitter to indicate relative priority. Actual job execution priority and preemption priority are computed by PBS. | <i>Integer.</i> Syntax:<br>$[+ -]nnnn$  | $[-1024, +1023]$ inclusive |                          | Unset                             | int                    | r, w           | r, w           | r, w           |
| <b>project</b><br>The job's project. A project is a way to tag jobs. Each job can belong to at most one project.   | <i>String.</i> Can contain any characters except for the following: Slash ("/"), left bracket ("["), right bracket ("]"), double quote ("\""), semicolon (";"), colon (":"), vertical bar (" "), left angle bracket ("<"), right angle bracket (">"), plus ("+"), comma (","), question mark ("?"), and asterisk ("*"). |                            |                          | <code>_pbs_project_default</code> | str                    | r, w           | r, w           | r, w           |
| <b>pstate</b><br>Power attribute. Cray ALPS reservation setting for CPU frequency corresponding to p-state. See BASIL 1.4 documentation.   | <i>String</i><br>Units: <i>Hertz</i>  |                            |                          | Unset                             | str                    | r, w           | r, w           | r, w           |
| <b>qtime</b><br>Timestamp; the time that the job entered the current queue.  | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch.   |                            |                          | No default                        | int                    | r              | r              | r              |
| <b>queue</b><br>The name of the queue in which the job currently resides.  | <i>String</i>   |                            |                          | No default                        | <code>pbs.queue</code> | r              | r              | r              |
| <b>queue_rank</b><br>A number indicating the job's position within its queue. Only used internally by PBS.   | <i>Integer</i>  |                            |                          | No default                        | int                    | -              | -              | r              |

| Job Attributes   |                  |              |   |              |                     |      |         |      |
|--|------------------|--------------|---|--------------|---------------------|------|---------|------|
| Name<br>Description  | Format           | Val / Opt    | Value/Option Description  | Def Val      | Python Type         | Job  | Options | MoM  |
| queue_type<br>The type of queue in which the job is currently residing.  | <i>Character</i> | <i>E</i>     | Execution queue   | No default   | pbs.QTYPE_EXECUTION | -    | -       | r    |
|  |                  | <i>R</i>     | Routing queue   |              | pbs.QTYPE_ROUTE     |      |         |      |
| release_nodes_on_stageout<br>Controls whether job vnodes are released when stageout begins.<br>When cgroups is enabled and this is used with some but not all vnodes from one MoM, resources on those vnodes that are part of a cgroup are not released until the entire cgroup is released.<br>The job's <code>stageout</code> attribute must be set for the <code>release_nodes_on_stageout</code> attribute to take effect. | <i>Boolean</i>   | <i>True</i>  | All of the job's vnodes not on the primary execution host are released when stageout begins | <i>False</i> | bool                | r, w | r, w    | r, w |
|  |                  | <i>False</i> | Job's vnodes are released when the job finishes and MoM cleans up the job                   |              |                     |      |         |      |
| Remove_Files<br>Specifies whether standard output and/or standard error files are automatically removed upon job completion.   | <i>String</i>    | <i>e</i>     | Standard error is removed upon job completion   | Unset        | str                 | r, w | r, w    | r, w |
|  |                  | <i>o</i>     | Standard output is removed upon job completion  |              |                     |      |         |      |
|  |                  | <i>eo</i>    | Standard output and standard error are removed upon job completion                          |              |                     |      |         |      |
|  |                  | <i>oe</i>    | Standard output and standard error are removed upon job completion                          |              |                     |      |         |      |
|  |                  | <i>unset</i> | Neither is removed  |              |                     |      |         |      |
| Rerunable<br>Specifies whether the job can be rerun. Does not affect how a job is treated if the job could not begin execution. See <a href="#">"Allowing Your Job to be Re-run"</a> , on page 120 of the PBS Professional User's Guide.<br>Job arrays are required to be rerunnable and are rerunnable by default.  | <i>Character</i> | <i>y</i>     | The job can be rerun.   | <i>y</i>     | bool                | r, w | r, w    | r, w |
|  |                  | <i>n</i>     | Once the job starts running, it can never be rerun.   |              |                     |      |         |      |

| Job Attributes   |  |           |                          |            |  |          |          |
|--|--|-----------|--------------------------|------------|--|----------|----------|
| Name<br>Description  | Format   | Val / Opt | Value/Option Description | Def Val    | Python Type  | Sub<br>W | Opt<br>W |
| <b>Resource_List</b><br>The list of resources required by the job.<br>List is a set of <code>&lt;resource name&gt;=&lt;value&gt;</code> strings. The meaning of name and value is dependent upon defined resources. Each value establishes the limit of usage of that resource. If not set, the value for a resource may be determined by a queue or server default established by the administrator. See <a href="#">Chapter 5, "List of Built-in Resources"</a> , on page 265. | <i>String</i> . Syntax:<br><code>Resource_List.&lt;resource name&gt;=&lt;value&gt;],</code><br><code>Resource_List.&lt;resource name&gt;=&lt;value&gt;, ...]</code>  |           |                          | No default | <code>pbs.pbs_resource</code><br><br>Syntax:<br><code>Resource_List["&lt;resource name&gt;"]=&lt;value&gt;</code> where <i>resource name</i> is any built-in or custom resource  | r, w     | r, w     |
| <b>resources_released</b><br>Listed by vnode, consumable resources that were released when the job was suspended. Populated only when <code>restrict_res_to_release_on_suspend</code> server attribute is set. Set by server.  | <i>String</i> . Syntax:<br><code>(&lt;vnode&gt;:&lt;resource name&gt;=&lt;value&gt;:&lt;resource name&gt;=&lt;value&gt;:...)+(&lt;vnode&gt;:&lt;resource name&gt;=&lt;value&gt;:...)</code>                |           |                          | No default | <code>str</code>   | r        | r        |
| <b>resource_released_list</b><br>Sum of each consumable resource requested by the job that was released when the job was suspended. Populated only when <code>restrict_res_to_release_on_suspend</code> server attribute is set. Set by server.  | <i>String</i> . Syntax:<br><code>resource_released_list.&lt;resource name&gt;=&lt;value&gt;, resource_released_list.&lt;resource name&gt;=&lt;value&gt;, ...</code>  |           |                          | No default | <code>pbs.pbs_resource</code>  | --       | r        |
| <b>resources_used</b><br>The amount of each resource used by the job.  | <i>String</i> . Syntax: List of <code>resources_used.&lt;resource name&gt;=&lt;value&gt;, resources_used.&lt;resource name&gt;=&lt;value&gt;</code> pairs. Example:<br><code>resources_used.mem=2mb</code> |           |                          | No default | <code>pbs.pbs_resource</code><br><br>Syntax:<br><code>resources_used["&lt;resource name&gt;"]=&lt;value&gt;</code> where <i>resource name</i> is any built-in or custom resource | r        | r        |



| Job Attributes  |   |                      |  |             |             |      |         |      |
|---|---|----------------------|--|-------------|-------------|------|---------|------|
| Name<br>Description   | Format  | Val / Opt            | Value/Option Description   | Def Val     | Python Type | Job  | Options | MoM  |
| <b>run_count</b><br>The number of times the server thinks the job or subjob has been executed.<br>The <code>run_count</code> attribute starts at zero. Job is held after 21 tries. When a subjob hits the <code>run_count</code> limit, it and its parent job array get a System hold.<br>Can be set via <code>qsub</code> , <code>qalter</code> , or a hook. | <i>Integer.</i><br>Must be greater than or equal to <i>zero</i> . |                      |  | <i>Zero</i> | int         | -    | r, w    | r, w |
| <b>run_version</b><br>Used internally by PBS to track the instance of the job.  | <i>Integer</i>  |                      |  |             | int         | --   | --      | r    |
| <b>sandbox</b><br>Specifies whether PBS creates job-specific staging and execution directories.<br>User-settable via <code>qsub -wsandbox=&lt;value&gt;</code> or via a PBS directive.<br>See the <code>\$jobdir_root</code> MoM configuration option.  | <i>String</i>   | <i>PRIVATE</i>       | PBS creates job-specific staging and execution directories under the directory specified in the <code>\$jobdir_root</code> MoM configuration option or under the submitter's home directory. | Unset       | str         | r, w | r, w    | r, w |
|   |   | <i>HOME</i> or unset | PBS uses the job owner's home directory for staging and execution.   |             |             |      |         |      |
| <b>schedselect</b><br>The union of the select specification of the job, and the queue and server defaults for resources in a chunk.   | <i>String</i>   |                      |  | No default  | pbs.select  | -    | -       | r    |
| <b>sched_hint</b><br>No longer used.  |   |                      |  |             |             | -    | -       | -    |
| <b>security_context</b><br>Contains security context of job submitter. Set by PBS to the security context of the job submitter at the time of job submission. If not present when a request is submitted, an error occurs, a server message is logged, and the request is rejected.   | <i>String in SELinux format</i>                                   |                      |  | Unset       | str         | r    | r       | r    |

| Job Attributes   |   |           |                          |                                      |                               |   |   |   |
|--|---|-----------|--------------------------|--------------------------------------|-------------------------------|---|---|---|
| Name<br>Description  | Format  | Val / Opt | Value/Option Description | Def Val                              | Python Type                   |  |  |  |
| <b>server</b><br>The name of the server which is currently managing the job. When the secondary server is running during failover, shows the name of the primary server. After a job is moved to another server, either via <code>qmove</code> or peer scheduling, shows the name of the new server. | <i>String</i>   |           |                          | No default                           | <code>pbs.server</code>       | r   | r   | r   |
| <b>session_id</b><br>If the job is running, this is set to the session ID of the first executing task.   |   |           |                          | No default                           | <code>int</code>              | r   | r   | r   |
| <b>Shell_Path_List</b><br>One or more absolute paths to the program(s) to process the job's script file.   | <i>String</i> . Syntax: " <code>&lt;path&gt;[@&lt;hostname&gt;][,&lt;path&gt;[@&lt;hostname&gt;]...]</code> " Must be enclosed in double quotes if it contains commas.  |           |                          | User's login shell on execution host | <code>pbs.path_list</code>    | r, w  | r, w  | r, w  |
| <b>stagein</b><br>The list of files to be staged in prior to job execution.  | <i>String</i> . Syntax: " <code>&lt;execution path&gt;@&lt;storage host&gt;:&lt;storage path&gt;[, &lt;execution path&gt;@&lt;storage host&gt;:&lt;storage path&gt;, ...]</code> " Must be enclosed in double quotes if it contains commas. |           |                          | No default                           | <code>pbs.staging_list</code> | r, w  | r, w  | r, w  |
| <b>stageout</b><br>The list of files to be staged out after job execution.   | <i>String</i> . Syntax: " <code>&lt;execution path&gt;@&lt;storage host&gt;:&lt;storage path&gt;[, &lt;execution path&gt;@&lt;storage host&gt;:&lt;storage path&gt;, ...]</code> " Must be enclosed in double quotes if it contains commas. |           |                          | No default                           | <code>pbs.staging_list</code> | r, w  | r, w  | r, w  |

| Job Attributes   |   |           |                          |            |             |                |                |                |
|--|---|-----------|--------------------------|------------|-------------|----------------|----------------|----------------|
| Name<br>Description  | Format  | Val / Opt | Value/Option Description | Def Val    | Python Type | $\mathfrak{S}$ | $\mathfrak{O}$ | $\mathfrak{M}$ |
| <b>Stageout_status</b><br>Status of stageout. If stageout succeeded, this is set to <i>1</i> . If stageout failed, this is set to <i>0</i> . Available only for finished jobs. Displayed only if set. If stageout fails for any subjob of an array job, the value of <b>Stageout_status</b> is zero for the array job. Available only for finished jobs. | <i>Integer</i>  |           |                          | No default | int         | r              | r              | r              |
| <b>stime</b><br>Timestamp; time when the job started execution. Changes when job is restarted.   | <i>Timestamp.</i><br>Printed by <code>qstat</code> in human-readable <i>Date</i> format.<br>Output in hooks as seconds since epoch. |           |                          | No default | int         | r              | r              | r              |
| <b>Submit_arguments</b><br>Job submission arguments given on the <code>qsub</code> command line. Available for all jobs.   | <i>String</i>   |           |                          | No default | str         | r,<br>w        | r,<br>w        | r,<br>w        |
| <b>substate</b><br>The substate of the job. The substate is used internally by PBS.  | <i>Integer</i>  |           |                          | No default | int         | r              | r              | r              |
| <b>sw_index</b><br>No longer used.   |   |           |                          |            |             | -              | -              | -              |

## Attributes

| Job Attributes  |                 |                    |   |   |             |         |         |         |
|---|-----------------|--------------------|---|---|-------------|---------|---------|---------|
| Name<br>Description   | Format          | Val / Opt          | Value/Option Description  | Def Val                                       | Python Type | Sub     | Opt     | Mod     |
| tolerate_node_failures<br>Specifies whether job can have extra vnodes allocated, and whether for startup only or for the life of the job.<br>Not supported on Cray.   | String          | <i>none, unset</i> | No extra vnodes are allocated to the job.   | None  | str         | r,<br>s | r,<br>s | r,<br>s |
|   |                 | <i>job_start</i>   | Extra vnodes are allocated only long enough to start the job successfully.<br><br>Tolerate vnode failures that occur only during job start, just before executing the job's top level shell or executable or any <code>execjob_launch</code> hooks.<br><br>Failures tolerated are those such as an assigned sister MoM failing to join the job and communication errors between MoMs. |   |             |         |         |         |
|   |                 | <i>all</i>         | Extra vnodes are allocated for the life of the job.<br><br>Tolerate all node failures resulting from communication problems, such as polling problems, between the primary MoM and the sister MoMs assigned to the job<br><br>Tolerate failures due to rejections from <code>execjob_begin</code> or <code>execjob_prologue</code> hooks run at sister MoMs.                          |   |             |         |         |         |
| topjob_ineligible<br>Allows administrators to mark this job as ineligible to be a top job.  | Boolean         | <i>True</i>        | This job is not eligible to be a top job.   | <i>Unset,</i><br>behaves like<br><i>False</i> | bool        | -       | -       | r,<br>w |
|   |                 | <i>False</i>       | This job is eligible to be a top job.   |   |             |         |         |         |
| umask<br>The initial umask of the job is set to the value of this attribute when the job is created. The umask may be changed by <code>umask</code> commands in the shell initialization files such as <code>.profile</code> or <code>.cshrc</code> . | Decimal integer |                    |   | <i>system default</i>                         | int         | r,<br>w | r,<br>w | r,<br>w |

| Job Attributes   |  |           |                          |   |   |                |                |
|--|--|-----------|--------------------------|---|---|----------------|----------------|
| Name<br>Description  | Format   | Val / Opt | Value/Option Description | Def Val                                 | Python Type   | $\mathfrak{S}$ | $\mathfrak{O}$ |
| <b>User_List</b><br>The list of users which determines the user name under which the job is run on a given host. No length limit.<br>When a job is to be executed, the server selects a user name from the list according to the following ordered set of rules:<br>1. Select the user name from the list for which the associated host name matches the name of the server.<br>2. Select the user name which has no associated host name; the wild card name.<br>3. Use the value of <b>Job_Owner</b> as the user name. | <i>String</i> . Syntax:<br>"<username>@<hostname> [,<username>@<hostname>...]" Must be enclosed in double quotes if it contains commas. May be up to 256 characters in length. |           |                          | Value of <b>Job_Owner</b> job attribute | pbs.user_list   | r, w           | r, w           |
| <b>Variable_List</b><br>List of environment variables set in the job's execution environment. See the <b>qsub(1B)</b> command.   | <i>String</i> . Syntax:<br>"<variable name>=<value> [,<variable name>=<value>...]" Must be enclosed in double quotes if it contains commas.                                    |           |                          | No default                              | pbs.pbs_resource<br>Syntax:<br>Variable_List["<variable name>"]=<value> | r, w           | r, w           |

## 6.12 Hook Attributes

An unset hook attribute takes the default value for that attribute.

Hook attributes can be set by root or the Admin at the local server only.

| Hook Attributes   |   |              |   |                  |                |     |    |     |  |
|---|---|--------------|---|------------------|----------------|-----|----|-----|--|
| Name<br>Description   | Format  | Val / Opt    | Value/Option Description                              | Default<br>Value | Python<br>Type | Usr | Op | Mgr |  |
| <b>alarm</b><br>Specifies the number of seconds to allow a hook to run before the hook times out.   | <i>Integer.</i><br>Must be greater than zero. |              |   | <i>30</i>        |                |     |    |     |  |
| <b>debug</b><br>Specifies whether or not the hook produces debugging files under <code>PBS_HOME/server_priv/hooks/tmp</code> or <code>PBS_HOME/mom_priv/hooks/tmp</code> . Files are named <i>hook_&lt;hook event&gt;_&lt;hook name&gt;_&lt;unique ID&gt;.in</i> , <i>.data</i> , and <i>.out</i> . See <a href="#">"Producing Files for Debugging" on page 185 in the PBS Professional Hooks Guide</a> . | <i>Boolean</i>                                | <i>True</i>  | The hook leaves debugging files when it runs.         | <i>False</i>     |                |     |    |     |  |
|   |   | <i>False</i> | The hook does not leave debugging files when it runs. |                  |                |     |    |     |  |
| <b>enabled</b><br>Determines whether or not a hook is run when its triggering event occurs.   | <i>Boolean</i>                                | <i>True</i>  | Hook runs when triggering event occurs.               | <i>True</i>      |                |     |    |     |  |
|   |   | <i>False</i> | Hook does not run when triggering event occurs.       |                  |                |     |    |     |  |

| Hook Attributes   |                     |                              |  |  |                |           |     |     |  |
|---|---------------------|------------------------------|--|--|----------------|-----------|-----|-----|--|
| Name<br>Description   | Format              | Val / Opt                    | Value/Option Description   | Default<br>Value                                       | Python<br>Type | Is<br>Def | Opt | Mgr |  |
| <b>event</b><br>List of events that trigger the hook. Can be operated on with the "=", "+=", and "-=" operators. The <i>provision</i> event cannot be combined with any other events. | <i>String_array</i> | " <i>queuejob</i> "          | Triggered before job is queued   | ""<br>mean-<br>ing<br>hook is<br>not<br>trig-<br>gered | str            |           |     |     |  |
|   |                     | " <i>postqueuejob</i> "      | Triggered after job is queued  |  |                |           |     |     |  |
|   |                     | " <i>modifyjob</i> "         | Triggered when job is modified   |  |                |           |     |     |  |
|   |                     | " <i>movejob</i> "           | Triggered when job is moved  |  |                |           |     |     |  |
|   |                     | " <i>runjob</i> "            | Triggered when job is run  |  |                |           |     |     |  |
|   |                     | " <i>jobobit</i> "           | Triggered when job or subjob leaves execution  |  |                |           |     |     |  |
|   |                     | " <i>resvsub</i> "           | Triggered when reservation is created  |  |                |           |     |     |  |
|   |                     | " <i>resv_confirm</i> "      | Triggered when reservation is confirmed  |  |                |           |     |     |  |
|   |                     | " <i>modifyresv</i> "        | Triggered when reservation is modified   |  |                |           |     |     |  |
|   |                     | " <i>resv_begin</i> "        | Triggered when reservation begins  |  |                |           |     |     |  |
|   |                     | " <i>resv_end</i> "          | Triggered when reservation ends  |  |                |           |     |     |  |
|   |                     | " <i>management</i> "        | Triggered by <i>qmgr</i> operations  |  |                |           |     |     |  |
|   |                     | " <i>modifyvnode</i> "       | Triggered by vnode state change  |  |                |           |     |     |  |
|   |                     | " <i>periodic</i> "          | Triggered periodically at server   |  |                |           |     |     |  |
|   |                     | " <i>provision</i> "         | Hook is master provisioning hook   |  |                |           |     |     |  |
|   |                     | " <i>execjob_begin</i> "     | Triggered when MoM receives job  |  |                |           |     |     |  |
|   |                     | " <i>execjob_prologue</i> "  | Triggered just before first job process  |  |                |           |     |     |  |
|   |                     | " <i>execjob_launch</i> "    | Triggered just before executing user's program   |  |                |           |     |     |  |
|   |                     | " <i>execjob_attach</i> "    | Triggered before any <i>execjob_prologue</i> hooks, on each vnode where <i>pbs_attach()</i> runs |  |                |           |     |     |  |
|   |                     | <i>execjob_postsuspend</i>   | Triggered just after successfully suspending a job   |  |                |           |     |     |  |
|   |                     | <i>execjob_preresume</i>     | Triggered just before resuming a job   |  |                |           |     |     |  |
|   |                     | " <i>execjob_preterm</i> "   | Triggered just before job is killed  |  |                |           |     |     |  |
|   |                     | " <i>execjob_epilogue</i> "  | Triggered after job runs successfully or is killed   |  |                |           |     |     |  |
|   |                     | " <i>execjob_end</i> "       | Triggered just after job is cleaned up   |  |                |           |     |     |  |
|   |                     | " <i>exechost_periodic</i> " | Triggered at periodic interval on execution hosts  |  |                |           |     |     |  |
|   |                     | " <i>exechost_startup</i> "  | Triggered when MoM starts up or receives SIGHUP (Linux)  |  |                |           |     |     |  |
|   |                     | ""                           | Hook is not triggered  |  |                |           |     |     |  |

| Hook Attributes   |              |   |   |                  |                |           |     |
|---|--------------|---|---|------------------|----------------|-----------|-----|
| Name<br>Description   | Format       | Val / Opt   | Value/Option Description  | Default<br>Value | Python<br>Type | Is<br>Opt | Mgr |
| <b>fail_action</b><br>Specifies the action to be taken when hook fails due to alarm call or unhandled exception, or to an internal error such as not enough disk space or memory. Can also specify a subsequent action to be taken when hook runs successfully. Value can be either "none" or one or more of "offline_vnodes", "clear_vnodes_upon_recovery", and "scheduler_restart_cycle".<br>If this attribute is set to multiple values, scheduler restart happens last.<br>See <a href="#">"Offlining and Clearing Vnodes Using the fail_action Hook Attribute" on page 72 in the PBS Professional Hooks Guide</a> and <a href="#">"Restarting Scheduler Cycle After Hook Failure" on page 69 in the PBS Professional Hooks Guide</a> . | String_array | "none"  | No action is taken.   | "none"           |                |           |     |
|   |              | "offline_vnodes"  | After unsuccessful hook execution, offlines the vnodes managed by the MoM executing the hook.<br>Only available for <code>execjob_prologue</code> , <code>exechost_startup</code> and <code>execjob_begin</code> hooks. |                  |                |           |     |
|   |              | "clear_vnodes_upon_recovery"  | After successful hook execution, clears vnodes previously offlined via "offline_vnodes" fail action.<br>Only available for <code>exechost_startup</code> hooks.   |                  |                |           |     |
|   |              | "scheduler_restart_cycle"   | After unsuccessful hook execution, restarts scheduling cycle. Only available for <code>execjob_begin</code> and <code>execjob_prologue</code> hooks.  |                  |                |           |     |
| <b>freq</b><br>Number of seconds between periodic or <code>exechost_periodic</code> triggers.   | Integer      |   | Number of seconds between triggers  | 120              |                |           |     |
| <b>order</b><br>Indicates relative order of hook execution, for hooks of the same type sharing a trigger. Hooks with lower order values execute before those with higher values.<br>Does not apply to <code>periodic</code> or <code>exechost_periodic</code> hooks.  | Integer      | Range:<br><i>built-in hooks: [-1000, 2000]</i><br><i>site hooks: [1,1000]</i> |   | 1                |                |           |     |
| <b>type</b><br>The type of the hook.<br>Cannot be set for a built-in hook.  | String       | pbs   | Hook is built in  | site             |                |           |     |
|   |              | site  | Hook is custom (site-defined)   |                  |                |           |     |
| <b>user</b><br>Specifies who executes the hook.   | String       | pbsadmin  | Hook runs as root   | pbsadmin         |                |           |     |
|   |              | pbsuser   | Hook runs as owner of job   |                  |                |           |     |



# 7

## Formats

This chapter describes the formats used in PBS Professional.

### 7.1 Non-resource Formats

#### Accounting Log Entry

*logfile-date-time;record-type;id-string;message-text*

where

*logfile-date-time*

Date and time stamp in the format:

*mm/dd/yyyy hh:mm:ss*

*record-type*

A single character indicating the type of record

*id-string*

The job or reservation identifier

*message-text*

Format: blank-separated *keyword=value* fields.

Message text is ASCII text.

Content depends on the record type.

#### Attribute Name

PBS NAME. Cannot be used for a vnode name.

#### Date

*<Day of week> <Name of month> <Day of month> <HH:MM:SS> <YYYY>*

## Datetime

A datetime is

*[[[CC]YY]MM]DD]hhmm[.SS]*

where

**Table 7-1: Datetime Symbols**

| Symbol    | Meaning      |
|-----------|--------------|
| <i>CC</i> | Century      |
| <i>YY</i> | Year         |
| <i>MM</i> | Month        |
| <i>DD</i> | Day of month |
| <i>hh</i> | Hour         |
| <i>mm</i> | Minute       |
| <i>SS</i> | Second       |

When setting the value, each portion of the date defaults to the current date, as long as the next-smaller portion is in the future. For example, if today is the 3rd of the month and the specified day *DD* is the 5th, the month *MM* will be set to the current month.

If a specified portion has already passed, the next-larger portion will be set to one after the current date. For example, if the day *DD* is not specified, but the hour *hh* is specified to be 10:00 a.m. and the current time is 11:00 a.m., the day *DD* will be set to tomorrow.

## Destination Identifier

String used to specify a particular destination. The identifier may be specified in one of three forms:

*<queue name>@<server name>*

*<queue name>*

*@<server name>*

where *<queue name>* is an ASCII character string of up to 15 characters.

Valid characters are alphanumerics, the hyphen and the underscore. The string must begin with a letter.

## Hostname

String of the form

*<machine name>.<domain name>*

where *domain name* is a hierarchical, dot-separated list of subdomains.

A hostname cannot contain the following:

- A dot ("."), other than as a subdomain separator
- The commercial at sign, "@", as this is often used to separate a file from the host in a remote file name
- To prevent confusion with port numbers, a hostname cannot contain a colon (":")

The maximum length of a hostname supported by PBS is 255.

## Job Array ID, Job Array Identifier

The identifier returned upon success when submitting a job array.

Job array identifiers are a sequence number followed by square brackets:

---

```
<sequence number>[[.<server name>][@<server name>]
```

Example:

```
1234[ ]
```

Note that some shells require that you enclose a job array ID in double quotes.

The largest value that *sequence number* can be is set in the `max_job_sequence_id` server attribute. This attribute defaults to `9999999`. Minimum value for this attribute is `9999999`, and maximum is `999999999999`. After maximum for sequence number has been reached, job array IDs start again at `0`.

### Job Array Range

```
<sequence number>[<first>-<last>][.<server name>][@<server name>]
```

*first* and *last* are the first and last indices of the subjobs.

### Job ID, Job Identifier

When a job is successfully submitted to PBS, PBS returns a unique identifier for the job. Format:

```
<sequence number>[.<server>][@<new server>]
```

The `<server>` portion indicates the name of the original server where the job was submitted.

The `@<new server>` portion indicates the current location of the job if it is not at the original server.

The largest value that *sequence number* can be is set in the `max_job_sequence_id` server attribute. This attribute defaults to `9999999`. Minimum value for this attribute is `9999999`, and maximum is `999999999999`. After maximum for sequence number has been reached, job IDs start again at `0`.

### Job Name, Job Array Name

A job name or job array name can be at most 230 characters. It must consist only of alphabetic, numeric, plus sign ("`+`"), dash or minus ("`-`"), underscore ("`_`"), and dot or period ("`.`") characters.

Default: if a script is used to submit the job, the job's name is the name of the script. If no script is used, the job's name is "`STDIN`".

**Limit Specification**

*<limit specification>=<limit value>[, <limit specification>=<limit value>, ...]*

where *limit specification* is:

**Table 7-2: Limit Specification Syntax**

| Limit Specification           | Limit                 |
|-------------------------------|-----------------------|
| <i>o:PBS_ALL</i>              | Overall limit         |
| <i>u:PBS_GENERIC</i>          | Generic users         |
| <i>u:&lt;username&gt;</i>     | An individual user    |
| <i>g:PBS_GENERIC</i>          | Generic groups        |
| <i>g:&lt;group name&gt;</i>   | An individual group   |
| <i>p:PBS_GENERIC</i>          | Generic projects      |
| <i>p:&lt;project name&gt;</i> | An individual project |

- The *limit specification* can contain spaces anywhere except after the colon (":").
- If there are comma-separated *limit specifications*, the entire string must be enclosed in double quotes.
- A username, group name, or project name containing spaces must be enclosed in quotes.
- If a username, group name, or project name is quoted using double quotes, and the entire string requires quotes, the outer enclosing quotes must be single quotes. Similarly, if the inner quotes are single quotes, the outer quotes must be double quotes.
- *PBS\_ALL* is a keyword which indicates that this limit applies to the usage total.
- *PBS\_GENERIC* is a keyword which indicates that this limit applies to generic users, groups, or projects.
- When removing a limit, the *limit value* does not need to be specified.
- *PBS\_ALL* and *PBS\_GENERIC* are case-sensitive.

Format for setting a limit attribute:

```
set server <limit attribute> = "<limit specification>=<limit value>[, <limit specification>=<limit value>], ..."
```

```
set queue <queue name> <limit attribute> = "<limit specification>=<limit value>[, <limit specification>=<limit value>], ..."
```

For example, to set the `max_queued` limit on QueueA to 5 for total usage, and to limit user bill to 3:

```
Qmgr: s q QueueA max_queued = "[o:PBS_ALL=5], [u:bill =3]"
```

Examples of setting, adding, and removing:

```
Qmgr: set server max_run="[u:PBS_GENERIC=2], [g:group1=10], [o:PBS_ALL = 100]"
```

```
Qmgr: set server max_run+="[u:user1=3], [g:PBS_GENERIC=8]"
```

```
Qmgr: set server max_run-="[u:user2], [g:group3]"
```

```
Qmgr: set server max_run_res.ncpus="[u:PBS_GENERIC=2], [g:group1=8], [o:PBS_ALL = 64]"
```

See ["How to Set Limits at Server and Queues" on page 293 in the PBS Professional Administrator's Guide.](#)

**Event logfile-date-time**

Date and time stamp in the format:

*mm/dd/yyyy hh:mm:ss[.xxxxxx]*

If microsecond logging is enabled, microseconds are logged using the *.xxxxxx* portion. Microseconds may be preceded by zeroes. Microsecond logging is controlled per host via the [PBS\\_LOG\\_HIGHRES\\_TIMESTAMP](#) configuration parameter or environment variable.

### pathname

All printable characters except for ampersand ("&")

### PBS NAME

"PBS NAME" is a generic term, used to describe various PBS entities. For example, attribute names are PBS NAMES.

Must start with an alphabetic character, and may contain only the following: alpha-numeric, underscore ("\_"), or dash ("-").

Do not use PBS keywords as PBS NAMES.

### PBS Password

The `pbs_ds_password` command generates passwords containing the following characters:

*0123456789abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ!@#%&^&()\*\_+*

When creating a password manually, do not use \ (backslash) or ' (backquote). This can prevent certain commands such as `pbs_server`, `pbs_ds_password`, and `printjob` from functioning properly, as they rely on connecting to the database.

### Project Name

A project name can contain any characters except for the following: slash ("/"), left bracket ("["), right bracket ("]"), double quote ("\""), semicolon(";"), colon(":"), vertical bar("|"), left angle bracket("<"), right angle bracket(">"), plus("+"), comma(","), question mark("?"), and asterisk("\*").

Default value: *"\_pbs\_project\_default"*.

### Queue ID, Queue Identifier

To specify a queue at the default server:

*<queue name>*

To specify all queues at a server:

*@<server name>*

To specify a queue at a specific server:

*<queue name>@<server name>*

### Queue Name

PBS NAME up to 15 characters in length

### Reservation ID, Reservation Identifier

Format for an advance reservation:

*R<sequence number>[.<server name>][@<server name>]*

Format for a standing reservation:

*S<sequence number>[.<server name>][@<server name>]*

Format for a maintenance reservation:

*M<sequence number>[.<server name>][@<server name>]*

The largest value that *sequence number* can be is set in the `max_job_sequence_id` server attribute. This attribute defaults to 9999999. Minimum value for this attribute is 9999999, and maximum is 99999999999. After maximum for sequence number has been reached, reservation IDs start again at 0.

## Reservation Name

Same as Job Name. See ["Job Name, Job Array Name" on page 359](#).

## Resource Name

[PBS NAME](#) up to 64 characters in length

Resource names are case-sensitive.

## Subjob Identifier

Subjob identifiers are a sequence number followed by square brackets enclosing the subjob's index:

`<sequence number>[<index>][.<server name>][@<server name>]`

Example:

1234[99]

## Timestamp

Output format varies depending on context:

- Printed by `qstat` in human-readable *Date* format
- Output in hooks as seconds since epoch

## Username

### Linux username:

String up to 256 characters in length. PBS supports usernames containing any printable, non-whitespace character except the at sign ("@"). Your platform may place additional limitations on usernames.

### Windows username:

Must conform to the POSIX-1 standard for portability:

- The username must contain only alphanumeric characters, dot (.), underscore (\_), and/or hyphen "-".
- The hyphen must not be the first letter of the username.
- If "@" appears in the username, it will assumed to be in the context of a Windows domain account: username@domainname.

An exception to the above rule is the space character, which is allowed. If a space character appears in a username string, it will be displayed quoted and must be specified in a quoted manner.

## Vnode Name

Hostname, IP address, or other legal string, according to the following:

- For the parent vnode, the vnode name must conform to legal name for a host; see [Hostname](#)
- For other vnodes, the vnode name can be alphanumeric and any of these:
  - (dash)
  - \_ (underscore)
  - @ (at sign)
  - [ (left bracket)
  - ] (right bracket)
  - # (hash)
  - ^ (caret)
  - / (slash)
  - \ (backslash)

---

. (period)

- Cannot be the same as an attribute name
- Vnode names are case-insensitive

## 7.2 Resource Formats

### Boolean

Name of Boolean resource is a string.

Values:

*TRUE, True, true, T, t, Y, y, 1*

*FALSE, False, false, F, f, N, n, 0*

### Duration

A period of time, expressed either as

*An integer whose units are seconds*

or

*[[hours:]minutes:]seconds[.milliseconds]*

in the form:

*[[[HH]HH:]MM:]SS[.milliseconds]*

Milliseconds are rounded to the nearest second.

### Float

Floating point. Allowable values: [+ -] 0-9 [[0-9] ...][.][[0-9] ...]

### Long

Long integer. Allowable values: 0-9 [[0-9] ...], and + and -

`<queue name>@<server name>`

### Size

Number of bytes or words. The size of a word is 64 bits.

Format: `<integer>[<suffix>]`

where *suffix* can be one of the following:

**Table 7-3: Size in Bytes**

| Suffix   | Meaning                | Size                                  |
|----------|------------------------|---------------------------------------|
| b or w   | Bytes or words         | 1                                     |
| kb or kw | Kilobytes or kilowords | 2 to the 10th, or 1024                |
| mb or mw | Megabytes or megawords | 2 to the 20th, or 1,048,576           |
| gb or gw | Gigabytes or gigawords | 2 to the 30th, or 1,073,741,824       |
| tb or tw | Terabytes or terawords | 2 to the 40th, or 1024 gigabytes      |
| pb or pw | Petabytes or petawords | 2 to the 50th, or 1,048,576 gigabytes |

Default: *bytes*

Note that when sorting vnodes, a scheduler rounds all resources of type **size** up to the nearest kb.

### String

Any character, including the space character.

Only one of the two types of quote characters, " or ', may appear in any given value.

Values: `[_a-zA-Z0-9][[_a-zA-Z0-9 !"#$%&'()*+,-./:;<=>?@[\\]^_`{|}~] ...]`

String resource values are case-sensitive. No limit on length.

### String Array

Comma-separated list of strings.

Strings in `string_array` may not contain commas. No limit on length.

Python type is *str*.

A string array resource with one value works exactly like a string resource.



# 8 States

This chapter lists and describes the states in PBS Professional.

## 8.1 Job States

Job states are abbreviated to one character.

**Table 8-1: Job States**

| State    | Numeric | Description   |
|----------|---------|---|
| <i>B</i> | 7       | Job arrays only: job array is begun, meaning that at least one subjob has started   |
| <i>E</i> | 5       | Job is exiting after having run   |
| <i>F</i> | 9       | Job is finished. Job has completed execution, job failed during execution, or job was deleted.  |
| <i>H</i> | 2       | Job is held. A job is put into a held state by the server or by a user or administrator. A job stays in a held state until it is released by a user or administrator. |
| <i>M</i> | 8       | Job was moved to another server   |
| <i>Q</i> | 1       | Job is queued, eligible to run or be routed   |
| <i>R</i> | 4       | Job is running  |
| <i>S</i> | 400     | Job is suspended by scheduler. A job is put into the suspended state when a higher priority job needs the resources.  |
| <i>T</i> | 0       | Job is in transition to or from a server  |
| <i>U</i> | 410     | Job is suspended due to workstation becoming busy   |
| <i>W</i> | 3       | Job is waiting for its requested execution time to be reached, or job is delayed due to stagein failure.  |
| <i>X</i> | 6       | Subjobs only; subjob is finished (expired.)   |

### 8.1.1 Job Substates

Job substates are numeric:

**Table 8-2: Job Substates**

| Substate Number | Substate Description                         |
|-----------------|--|
| 00              | Transit in, prior to waiting for commit      |
| 01              | Transit in, waiting for commit               |
| 02              | transiting job outbound, not ready to commit |

**Table 8-2: Job Substates**

| <b>Substate Number</b> | <b>Substate Description</b>                                       |
|------------------------|---|
| 03                     | transiting outbound, ready to commit                              |
| 10                     | Job queued and ready for scheduling                               |
| 11                     | job queued, has files to stage in                                 |
| 13                     | Job waiting on sync start ready                                   |
| 14                     | job staging in files before waiting                               |
| 15                     | job staging in files before running                               |
| 16                     | job stage in complete   |
| 20                     | job held - user or operator                                       |
| 21                     | job held waiting on sync regist                                   |
| 22                     | job held - waiting on dependency                                  |
| 30                     | Job waiting until user-specified execution time                   |
| 37                     | job held - file stage in failed                                   |
| 41                     | job sent to MoM to run  |
| 42                     | Running   |
| 43                     | Suspended by Operator or Manager                                  |
| 45                     | Suspended by scheduler  |
| 50                     | Server received job obit  |
| 51                     | Staging out stdout/err and other files                            |
| 52                     | Deleting stdout/err files and staged-in files                     |
| 53                     | MoM releasing resources   |
| 54                     | Job is being aborted by server                                    |
| 56                     | (Set by MoM) Mother Superior telling sisters to kill everything   |
| 57                     | (Set by MoM) job epilogue running                                 |
| 58                     | (Set by MoM) job obit notice sent                                 |
| 59                     | Waiting for site-defined job termination action script            |
| 60                     | Job to be rerun, MoM sending stdout/stderr back to server         |
| 61                     | Job to be rerun, staging out files                                |
| 62                     | Job to be rerun, deleting files                                   |
| 63                     | Job to be rerun, freeing resources                                |
| 69                     | subjob is gone  |
| 70                     | Array job has begun   |
| 71                     | Job is waiting for vnode(s) to be provisioned with requested AOE. |

**Table 8-2: Job Substates**

| Substate Number | Substate Description   |
|-----------------|--|
| 72              | Waiting to join job  |
| 91              | Job is terminated  |
| 92              | Job is finished  |
| 93              | Job failed   |
| 94              | Job was moved  |
| 153             | (Set by MoM) Mother Superior waiting for delete ACK from sisters |

## 8.2 Job Array States

Job array states map closely to job states except for the '*B*' state. The '*B*' state applies to job arrays and indicates that at least one subjob has left the queued state and is running or has run, but not all subjobs have run. Job arrays will never be in the '*R*', '*S*' or '*U*' states.

**Table 8-3: Job Array States**

| State    | Numeric | Indication   |
|----------|---------|--|
| <i>B</i> | 7       | The job array has started  |
| <i>E</i> | 5       | All subjobs are finished and the server is cleaning up the job array   |
| <i>F</i> | 9       | The job array is finished  |
| <i>H</i> | 2       | The job array is held  |
| <i>Q</i> | 1       | The job array is queued, or has been qrerun  |
| <i>T</i> | 0       | The job array is in transit between servers  |
| <i>W</i> | 3       | The job array is waiting for its execution time to be reached, or job array was delayed due to stagein failure |

## 8.3 Subjob States

Subjobs can be in one of six states, listed here.

**Table 8-4: Subjob States**

| State    | Numeric | Indication |
|----------|---------|------------|
| <i>E</i> | 5       | Ending     |
| <i>F</i> | 9       | Finished   |
| <i>Q</i> | 1       | Queued     |
| <i>R</i> | 4       | Running    |

**Table 8-4: Subjob States**

| State    | Numeric                           | Indication   |
|----------|-----------------------------------|--|
| <i>S</i> | <i>None; sub-state of Running</i> | Suspended  |
| <i>U</i> | <i>None; sub-state of Running</i> | Suspended by keyboard activity                                     |
| <i>X</i> | 6                                 | Expired or deleted; subjob has completed execution or been deleted |

## 8.4 Server States

The state of the server is shown in the `server_state` server attribute. Possible values are shown in the following table:

**Table 8-5: Server States**

| State                      | Description   |
|----------------------------|---|
| <i>Hot_Start</i>           | The server has been started so that it will run first any jobs that were running when the server was shut down.<br>Python type: <code>pbs.SV_STATE_HOT</code>                           |
| <i>Idle</i>                | The server is running. The scheduler is between scheduling cycles.<br>Python type: <code>pbs.SV_STATE_IDLE</code>   |
| <i>Scheduling</i>          | The server is running. The scheduler is in a scheduling cycle.<br>Python type: <code>pbs.SV_STATE_ACTIVE</code>   |
| <i>Terminating</i>         | The server is terminating.<br>Python type: <code>pbs.SV_STATE_SHUTIMM</code> or <code>pbs.SV_STATE_SHUTSIG</code>   |
| <i>Terminating_Delayed</i> | The server is terminating in delayed mode. No new jobs will be run, and the server will shut down when the last running job finishes.<br>Python type: <code>pbs.SV_STATE_SHUTDEL</code> |

## 8.5 Vnode States

If a vnode's **state** attribute is unset, that is equivalent to the state being *free*. A vnode's state is shown in its **state** attribute, which can take on zero or more of the values listed here. Some vnode state values can be set simultaneously. Values are:

**Table 8-6: Vnode States**

| State Name           | Set By              | Description   | Can Combine With these States   |
|----------------------|---------------------|---|---|
| <i>busy</i>          | Server              | Node is up and has load average greater than <code>max_load</code> , or is showing keyboard or mouse activity. When the loadave is above <code>max_load</code> , that node is marked <i>busy</i> . A scheduler won't place jobs on a node marked <i>busy</i> . When the loadave drops below <code>ideal_load</code> , or when the mouse and keyboard have not shown any activity for a specified amount of time, the <i>busy</i> mark is removed. Consult your OS documentation to determine values that make sense.  | <i>offline</i><br><i>maintenance</i>  |
| <i>down</i>          | Server              | Node is not usable. Existing communication lost between server and MoM.   | <i>maintenance</i><br>Cannot be set with <i>free</i>                            |
| <i>free</i>          | Server              | Node is up and has available CPU(s). Server will mark a vnode " <i>free</i> " on first successful ping after vnode was " <i>down</i> ".   | None  |
| <i>job-busy</i>      | Server              | Node is up and all CPUs are allocated to jobs.  | <i>offline</i><br><i>resv-exclusive</i>   |
| <i>job-exclusive</i> | Server              | Node is up and has been allocated exclusively to a single job.  | <i>offline</i><br><i>resv-exclusive</i>   |
| <i>maintenance</i>   | Server              | A vnode enters the <i>maintenance</i> state when any of its jobs is suspended with the <i>admin-suspend</i> signal. Other jobs running on this vnode continue to run; each job must be <i>admin-suspended</i> . The vnode leaves the <i>maintenance</i> state when the last job is resumed with the <i>admin-resume</i> signal. A scheduler does not start or resume jobs on a node in the <i>maintenance</i> state.<br><br>Any reservations on vnodes in the <i>maintenance</i> state are marked <i>degraded</i> . PBS searches for alternate vnodes for those reservations. | <i>down</i><br><i>offline</i>   |
| <i>offline</i>       | Manager<br>Operator | Node is not usable. Jobs running on this vnode will continue to run. Used by Manager/Operator to mark a vnode not to be used for jobs.  | <i>busy</i><br><i>job-busy</i><br><i>job-exclusive</i><br><i>resv-exclusive</i> |
| <i>powered-off</i>   |                     | Indicates that this vnode was powered off by PBS via power provisioning. This tells the scheduler that it can schedule jobs on this vnode; in that case PBS powers the vnode back up.   |   |
| <i>powering-down</i> |                     | Indicates that this vnode is in the process of being powered down by PBS via power provisioning.  |   |

Table 8-6: Vnode States

| State Name                 | Set By | Description  | Can Combine With these States       |
|----------------------------|--------|--|-------------------------------------|
| <i>powering-on</i>         |        | Indicates that this vnode is in the process of being powered up by PBS via power provisioning.   |                                     |
| <i>provisioning</i>        | Server | A vnode is in the provisioning state while it is in the process of being provisioned. No jobs are run on vnodes in the provisioning state.   | Cannot be set with any other states |
| <i>resv-exclusive</i>      | Server | Reservation has requested exclusive use of vnode, and reservation is running.  | <i>job-exclusive, offline</i>       |
| <i>sleep</i>               | Server | Indicates that this vnode was ramped down or powered off via PBS power management. This tells the scheduler that it can schedule jobs on this vnode; in that case PBS powers the vnode back up.  |                                     |
| <i>stale</i>               | Server | MoM managing vnode is not reporting any information about this vnode, but was reporting it previously. Server can still communicate with MoM.<br>A vnode becomes <i>stale</i> when:<br>1. A vnode is defined in the server<br>2. MoM starts or restarts and reports a set of vnodes according to her configuration<br>3. A vnode which existed in the server earlier is not in the set being reported now by MoM<br>4. That vnode is marked " <i>stale</i> " | Cannot be set with <i>free</i>      |
| <i>state-unknown, down</i> | Server | Node is not usable. Since server's latest start, no communication with this vnode. May be network or hardware problem, or no MoM on vnode.   |                                     |
| <i>unresolvable</i>        | Server | Server cannot resolve name of vnode  |                                     |
| <i>wait-provisioning</i>   | Server | There is a limit on the maximum number of vnodes that can be in the provisioning state. This limit is specified in the server's <code>max_concurrent_provision</code> attribute. If a vnode is to be provisioned, but cannot because the number of concurrently provisioning vnodes has reached the specified maximum, the vnode goes into the <i>wait-provisioning state</i> . No jobs are run on vnodes in the <i>wait-provisioning state</i> .            | Cannot be set with any other states |

## 8.6 Reservation States

The following table shows the list of possible states for a reservation. The states that you will usually see are *CO*, *UN*, *BD*, and *RN*, although a reservation usually remains unconfirmed for too short a time to see that state.

**Table 8-7: Reservation States**

| Numeric | Code      | State                     | Description  |
|---------|-----------|---------------------------|--|
| 0       | <i>NO</i> | <i>RESV_NONE</i>          | No reservation yet   |
| 1       | <i>UN</i> | <i>RESV_UNCONFIRMED</i>   | Reservation not confirmed  |
| 2       | <i>CO</i> | <i>RESV_CONFIRMED</i>     | Reservation confirmed  |
| 3       | <i>WT</i> | <i>RESV_WAIT</i>          | Unused   |
| 4       | <i>TR</i> | <i>RESV_TIME_TO_RUN</i>   | Transitory state; reservation's start time has arrived                               |
| 5       | <i>RN</i> | <i>RESV_RUNNING</i>       | Time period from reservation's start time to end time is being traversed             |
| 6       | <i>FN</i> | <i>RESV_FINISHED</i>      | Transitory state; reservation's end time has arrived and reservation will be deleted |
| 7       | <i>BD</i> | <i>RESV_BEING_DELETED</i> | Transitory state; reservation is being deleted                                       |
| 8       | <i>DE</i> | <i>RESV_DELETED</i>       | Transitory state; reservation has been deleted                                       |
| 9       | <i>DJ</i> | <i>RESV_DELETING_JOBS</i> | Jobs remaining after reservation's end time being deleted                            |
| 10      | <i>DG</i> | <i>RESV_DEGRADED</i>      | Vnode(s) allocated to reservation unavailable  |
| 11      | <i>AL</i> | <i>RESV_BEING_ALTERED</i> | Transitory state; reservation is being altered                                       |
| 12      | <i>IC</i> | <i>RESV_IN_CONFLICT</i>   | This reservation conflicts with a maintenance reservation                            |

## 8.6.1 Degraded Reservation Substates

The following table shows states and substates for degraded reservations:

**Table 8-8: Degraded Reservation States and Substates**

| Occurrence Type  | Reservation Time Is Now |                         | Reservation Time in Future |                         |
|--|-------------------------|-------------------------|----------------------------|-------------------------|
|  | State                   | Substate                | State                      | Substate                |
| Advance and job-specific reservation: running  | <i>RESV_RUNNING</i>     | <i>RESV_DEGRADED</i>    | <i>RESV_DEGRADED</i>       | <i>RESV_DEGRADED</i>    |
| Advance and job-specific reservation: conflicts with maintenance reservation             | <i>RESV_DEGRADED</i>    | <i>RESV_IN_CONFLICT</i> | <i>RESV_DEGRADED</i>       | <i>RESV_IN_CONFLICT</i> |
| Standing reservation soonest occurrence: running   | <i>RESV_RUNNING</i>     | <i>RESV_DEGRADED</i>    | <i>RESV_DEGRADED</i>       | <i>RESV_DEGRADED</i>    |
| Standing reservation soonest occurrence: conflicts with maintenance reservation          | <i>RESV_DEGRADED</i>    | <i>RESV_IN_CONFLICT</i> | <i>RESV_DEGRADED</i>       | <i>RESV_IN_CONFLICT</i> |
| Standing reservation non-soonest occurrence only: conflicts with maintenance reservation | <i>N/A</i>              | <i>N/A</i>              | <i>RESV_CONFIRMED</i>      | <i>RESV_DEGRADED</i>    |
|  | <i>N/A</i>              | <i>N/A</i>              | <i>RESV_RUNNING</i>        | <i>RESV_RUNNING</i>     |



# The PBS Configuration File

## 9.1 Format of Configuration File

Each line in the `/etc/pbs.conf` file gives a value for one parameter, or is a comment, or is blank. The order of the elements is not important.

### 9.1.1 Specifying Parameters

When you specify a parameter value, do not include any spaces in the line. Format for specifying a parameter value:

```
<parameter>=<value>
```

For example, to specify a value for `PBS_START_MOM` on the local host:

```
PBS_START_MOM=1
```

### 9.1.2 Comment Lines in Configuration File

You can comment out lines you are not using. Precede a comment with the hashmark ("`#`"). For example:

```
#This is a comment line
```

## 9.2 Contents of Configuration File

The `/etc/pbs.conf` file contains configuration parameters for PBS. The following table describes the parameters you can use in the `pbs.conf` configuration file:

**Table 9-1: Parameters in pbs.conf**

| Parameter                  | Description  |
|----------------------------|--|
| PBS_AUTH_METHOD            | Specifies authentication method and library to be used by PBS. Used only at authenticating client. Case-insensitive. See <a href="#">"Communication Authentication" on page 528 in the PBS Professional Administrator's Guide</a><br>Default value: <i>resvport</i><br>To use MUNGE, set to <i>munge</i> |
| PBS_AUTH_SERVICE_USERS     | Specifies list of users allowed to connect to comm daemon. Defined at comm daemon host. Comma-separated list of usernames. Example:<br>PBS_AUTH_SERVICE_USERS=root,pbsadmin<br>Default: <i>root</i>  |
| PBS_BATCH_SERVICE_PORT     | Port on which server listens. Default: <i>15001</i>  |
| PBS_BATCH_SERVICE_PORT_DIS | DIS port on which server listens.  |

Table 9-1: Parameters in pbs.conf

| Parameter                      | Description  |
|--------------------------------|--|
| PBS_CERT_DIR                   | Directory containing TLS certificates. If this parameter is defined, <code>pbs_update_certs</code> uses the TLS certificates in this directory instead of generating them.   |
| PBS_CLIENT_CONN_RETRY_INTERVAL | Interval in seconds at which <code>qsub</code> attempts to establish a socket when connecting to the server before timing out.<br><br>This attribute takes effect only when <code>PBS_CLIENT_CONN_RETRY_TIMEOUT</code> is $> 0$ and is $\geq$ this attribute.<br><br>Overridden by the <code>PBS_CLIENT_CONN_RETRY_INTERVAL</code> environment variable.<br><br>Default: 30  |
| PBS_CLIENT_CONN_RETRY_TIMEOUT  | Maximum time in seconds that <code>qsub</code> will try to establish a socket when connecting to the server.<br><br>When this attribute is set to 0 (zero), <code>PBS_CLIENT_CONN_RETRY_INTERVAL</code> is disabled (no retry, meaning that <code>qsub</code> immediately gives up trying to establish a socket).<br><br>This attribute takes effect only when it is $> 0$ and $\geq$ <code>PBS_CLIENT_CONN_RETRY_INTERVAL</code> .<br><br>Overridden by the <code>PBS_CLIENT_CONN_RETRY_TIMEOUT</code> environment variable.<br><br>Default: 0 (disabled) |
| PBS_COMM_LOG_EVENTS            | Communication daemon log mask. Default: 511  |
| PBS_COMM_ROUTERS               | Tells a <code>pbs_comm</code> the location of the other <code>pbs_comms</code> .   |
| PBS_COMM_THREADS               | Number of threads for communication daemon.  |
| PBS_CORE_LIMIT                 | Limit on corefile size for PBS daemons. Can be set to an integer number of bytes or to the string "unlimited". If unset, core file size limit is inherited from the shell environment.   |
| PBS_CP                         | Specifies command for MoM to use for local copy  |
| PBS_DAEMON_SERVICE_USER        | Username under which scheduler(s) run. Default: root   |
| PBS_DATA_SERVICE_PORT          | Used to specify non-default port for connecting to data service. Default: 15007  |
| PBS_ENCRYPT_METHOD             | Specifies method and library for encrypting and decrypting data in client-server communication. Used only at authentication client side. Case-insensitive.<br><br>To use TLS encryption in client-server communication, set this parameter to <code>tls</code> .<br><br>No default; if this is not set, PBS does not encrypt or decrypt data.  |
| PBS_ENVIRONMENT                | Location of <code>pbs_environment</code> file.   |
| PBS_EXEC                       | Location of PBS <code>bin</code> and <code>sbin</code> directories.  |
| PBS_HOME                       | Location of PBS working directories.   |

Table 9-1: Parameters in pbs.conf

| Parameter                   | Description   |
|-----------------------------|---|
| PBS_INTERACTIVE_AUTH_METHOD | <p>Specifies authentication method and library to be used for interactive jobs. Defined at each client host. See <a href="#">"Communication Authentication" on page 528 in the PBS Professional Administrator's Guide</a>.</p> <p>Specified method must be available in PBS_SUPPORTED_AUTH_METHODS at execution host.</p> <p>Default value: <i>resvport</i></p> <p>To use MUNGE, set to <i>munge</i></p>  |
| PBS_LEAF_NAME               | <p>Tells endpoint what hostname to use for network.</p> <p>The value does not include a port, since that is usually set by the daemon.</p> <p>By default, the name of the endpoint's host is the hostname of the machine. You can set the name where an endpoint runs. This is useful when you have multiple networks configured, and you want PBS to use a particular network.</p> <p>The server only queries for the canonicalized address of the MoM host, unless you let it know via the Mom attribute; if you have set PBS_LEAF_NAME in <code>/etc/pbs.conf</code> to something else, make sure you set the Mom attribute at vnode creation.</p> <p>TPP internally resolves the name to a set of IP addresses, so you do not affect how <code>pbs_comm</code> works.</p> |
| PBS_LEAF_ROUTERS            | Location of endpoint's <code>pbs_comm</code> daemon(s).   |
| PBS_LOCALLOG=<value>        | <p>Enables logging to local PBS log files. Valid values:</p> <p>0: no local logging</p> <p>1: local logging enabled</p> <p>Only available when using <code>syslog</code>.</p>   |
| PBS_LOG_HIGHRES_TIMESTAMP   | <p>Controls whether daemons on this host log timestamps in microseconds. Default timestamp log format is <i>HH:MM:SS</i>. With microsecond logging, format is <i>HH:MM:SS:XXXXXX</i>.</p> <p>Does not affect accounting log. Not applicable when using <code>syslog</code>.</p> <p>Overridden by environment variable of the same name.</p> <p>Valid values: <i>0</i>, <i>1</i>. Default: <i>0</i> (no microsecond logging)</p>   |
| PBS_MAIL_HOST_NAME          | <p>Used in addressing mail regarding jobs and reservations that is sent to users specified in a job or reservation's <code>Mail_Users</code> attribute.</p> <p>Optional. If specified, must be a fully qualified domain name. Cannot contain a colon (":"). For how this is used in email address, see <a href="#">section 2.2.3, "Specifying Mail Delivery Domain", on page 24</a>.</p>  |
| PBS_MANAGER_SERVICE_PORT    | Port on which MoM listens. Default: 15003   |
| PBS_MOM_HOME                | Location of MoM working directories.  |

Table 9-1: Parameters in pbs.conf

| Parameter            | Description  |
|----------------------|--|
| PBS_MOM_NODE_NAME    | <p>Name that MoM should use for parent vnode, and if they exist, child vnodes. If this is not set, MoM defaults to using the non-canonicalized hostname returned by <code>gethostname()</code>.</p> <p>If you use the IP address for a vnode name, set <code>PBS_MOM_NODE_NAME=&lt;IP address&gt;</code> in <code>pbs.conf</code> on the execution host.</p> <p>Dots are not allowed in this parameter unless they are part of an IP address.</p>  |
| PBS_MOM_SERVICE_PORT | Port on which MoM listens. Default: 15002  |
| PBS_OUTPUT_HOST_NAME | <p>Host to which all job standard output and standard error are delivered. If specified in <code>pbs.conf</code> on a job submission host, the value of <code>PBS_OUTPUT_HOST_NAME</code> is used in the host portion of the job's <code>Output_Path</code> and <code>Error_Path</code> attributes. If the job submitter does not specify paths for standard output and standard error, the current working directory for the <code>qsub</code> command is used, and the value of <code>PBS_OUTPUT_HOST_NAME</code> is appended after an at sign ("<code>@</code>"). If the job submitter specifies only a file path for standard output and standard error, the value of <code>PBS_OUTPUT_HOST_NAME</code> is appended after an at sign ("<code>@</code>"). If the job submitter specifies paths for standard output and standard error that include host names, the specified paths are used.</p> <p>Optional. If specified, must be a fully qualified domain name. Cannot contain a colon ("<code>:</code>"). See <a href="#">"Delivering Output and Error Files" on page 62 in the PBS Professional Administrator's Guide</a>.</p> |
| PBS_PRIMARY          | <p>Hostname of primary server. Used only for failover configuration. Overrides <code>PBS_SERVER_HOST_NAME</code>.</p> <p>If you set <code>PBS_LEAF_NAME</code> on the primary server host, make sure that <code>PBS_PRIMARY</code> matches <code>PBS_LEAF_NAME</code> on the corresponding host. If you do not set <code>PBS_LEAF_NAME</code> on the server host, make sure that <code>PBS_PRIMARY</code> matches the hostname of the server host.</p>   |
| PBS_RCP              | Location of <code>rcp</code> command if <code>rcp</code> is used.  |
| PBS_REMOTE_VIEWER    | <p>Specifies remote viewer client.</p> <p>If not specified, PBS uses native Remote Desktop client for remote viewer.</p> <p>Set on submission host(s).</p> <p>Supported on Windows only.</p>   |
| PBS_SCHED_THREADS    | <p>Maximum number of scheduler threads. Scheduler automatically caps number of threads at the number of cores (or hyperthreads if applicable), regardless of value of this variable.</p> <p>Overridden by <code>pbs_sched -t</code> option and <code>PBS_SCHED_THREADS</code> environment variable.</p> <p>Default: 1</p>  |

Table 9-1: Parameters in pbs.conf

| Parameter                  | Description   |
|----------------------------|---|
| PBS_SCP                    | Location of <code>scp</code> command if <code>scp</code> is used; setting this parameter causes PBS to first try <code>scp</code> rather than <code>rcp</code> for file transport.  |
| PBS_SECONDARY              | <p>Hostname of secondary server. Used only for failover configuration. Overrides <code>PBS_SERVER_HOST_NAME</code>.</p> <p>If you set <code>PBS_LEAF_NAME</code> on the secondary server host, make sure that <code>PBS_SECONDARY</code> matches <code>PBS_LEAF_NAME</code> on the corresponding host. If you do not set <code>PBS_LEAF_NAME</code> on the server host, make sure that <code>PBS_SECONDARY</code> matches the hostname of the server host.</p>                                  |
| PBS_SERVER                 | <p>Hostname of host running the server. Cannot be longer than 255 characters. If the short name of the server host resolves to the correct IP address, you can use the short name for the value of the <code>PBS_SERVER</code> entry in <code>pbs.conf</code>. If only the FQDN of the server host resolves to the correct IP address, you must use the FQDN for the value of <code>PBS_SERVER</code>.</p> <p>Overridden by <code>PBS_SERVER_HOST_NAME</code> and <code>PBS_PRIMARY</code>.</p> |
| PBS_SERVER_HOST_NAME       | <p>The FQDN of the server host. Used by clients to contact server. Overridden by <code>PBS_PRIMARY</code> and <code>PBS_SECONDARY</code> failover parameters. Overrides <code>PBS_SERVER</code> parameter. Optional. If specified, must be a fully qualified domain name. Cannot contain a colon (":"). See <a href="#">"Contacting the Server" on page 61 in the PBS Professional Administrator's Guide</a>.</p>   |
| PBS_START_COMM             | Set this to <code>1</code> if a communication daemon is to run on this host.  |
| PBS_START_MOM              | Default is <code>0</code> . Set this to <code>1</code> if a MoM is to run on this host.   |
| PBS_START_SCHED            | <b>Deprecated.</b> Set this to <code>1</code> if default scheduler is to run on this host. Overridden by scheduler's <code>scheduling</code> attribute.   |
| PBS_START_SERVER           | Set this to <code>1</code> if server is to run on this host.  |
| PBS_SUPPORTED_AUTH_METHODS | <p>Specifies supported authentication methods for client-server communication. Used by authenticating server (PBS server, scheduler, MoM, or comm); ignored at client. Case-insensitive.</p> <p>If this parameter is set, PBS accepts only the methods listed.</p> <p>Format: comma-separated list of authentication methods.</p> <p>Default value: <i>resvport</i></p> <p>Example: <i>munge,GSS</i></p>  |

**Table 9-1: Parameters in pbs.conf**

| Parameter              | Description  |
|------------------------|--|
| PBS_SYSLOG=<value>     | Controls use of <code>syslog</code> facility under which the entries are logged.<br>Valid values:<br>0: no syslogging<br>1: logged via LOG_DAEMON facility<br>2: logged via LOG_LOCAL0 facility<br>3: logged via LOG_LOCAL1 facility<br>...<br>9: logged via LOG_LOCAL7 facility |
| PBS_SYSLOGSEVR=<value> | Filters <code>syslog</code> messages by severity. Valid values:<br>0: only LOG_EMERG messages are logged<br>1: messages up to LOG_ALERT are logged<br>...<br>7: messages up to LOG_DEBUG are logged  |
| PBS_TMPDIR             | Location of temporary files/directories used by PBS components.  |
| PBS_WEBAPI_PORT        | Port where PBS server provides API endpoint.<br>Default: 8080  |
| PBS_WEBAPI_TLS         | Boolean. When set to <i>1</i> , the PBS server listens to the API endpoint in HTTPS mode.<br>Default: <i>1</i>   |

# 10

## Log Levels

### 10.1 Log Levels

PBS allows specification of the types of events that are logged for each daemon. Each type of log event has a different log level. All daemons use the same log level for the same type of event.

The following table lists the log level for each type of event.

**Table 10-1: PBS Events and Log Levels**

| Name               | Decimal | Hex    | Event Description  |
|--------------------|---------|--------|--|
| PBSEVENT_ERROR     | 1       | 0x0001 | Internal PBS errors  |
| PBSEVENT_SYSTEM    | 2       | 0x0002 | System (OS) errors, such as malloc failure                         |
| PBSEVENT_ADMIN     | 4       | 0x0004 | Administrator-controlled events, such as changing queue attributes |
| PBSEVENT_JOB       | 8       | 0x0008 | Job related events, e.g. submitted, ran, deleted                   |
| PBSEVENT_JOB_USAGE | 16      | 0x0010 | Job resource usage   |
| PBSEVENT_SECURITY  | 32      | 0x0020 | Security related events  |
| PBSEVENT_SCHED     | 64      | 0x0040 | When the scheduler was called and why                              |
| PBSEVENT_DEBUG     | 128     | 0x0080 | Common debug messages  |
| PBSEVENT_DEBUG2    | 256     | 0x0100 | Debug event class 2  |
| PBSEVENT_RESV      | 512     | 0x0200 | Reservation-related messages                                       |
| PBSEVENT_DEBUG3    | 1024    | 0x0400 | Debug event class 3. Debug messages rarer than event class 2.      |
| PBSEVENT_DEBUG4    | 2048    | 0x0800 | Debug event class 4. Limit-related messages.                       |





# 11

## Job Exit Status

### 11.1 Job Exit Status

The exit status of a job may fall in one of three ranges, listed in the following table:

**Table 11-1: Job Exit Status Ranges**

| Exit Status Range          | Reason                                   | Description   |
|----------------------------|--|---|
| $X < 0$                    | The job could not be executed            | See <a href="#">Table 11-2, “Job Exit Codes,” on page 382</a>   |
| $0 \leq X < 128$           | Exit value of shell or top process       | <p>This is the exit value of the top process in the job, typically the shell. This may be the exit value of the last command executed in the shell or the <code>.logout</code> script if the user has such a script (<code>csch</code>).</p> <p>The exit status of an interactive job is always recorded as 0 (zero), regardless of the actual exit status.</p>   |
| $X \geq 128$ and $X < 254$ | Job was killed with a signal             | <p>This means the job was killed with a signal. The signal is given by <math>X</math> modulo 128 (or 256). For example an exit value of 137 means the job's top process was killed with signal 9 (<math>137 \% 128 = 9</math>).</p> <p>The exit status values greater than 128 (or 256) indicate which signal killed the job. Depending on the system, values greater than 128 (or on some systems 256; see <code>wait(2)</code> or <code>waitpid(2)</code> for more information), are the value of the signal that killed the job.</p> <p>To interpret (or "decode") the signal contained in the exit status value, subtract the base value from the exit status. For example, if a job had an exit status of 143, that indicates the job was killed via a <code>SIGTERM</code> (e.g. <math>143 - 128 = 15</math>, signal 15 is <code>SIGTERM</code>). See the <code>kill(1)</code> manual page for a mapping of signal numbers to signal name on your operating system.</p> |
| $X = 254$                  | Job had an <code>execve()</code> failure | <p>This means that the job experienced a failure during <code>execve()</code>, e.g.:</p> <ul style="list-style-type: none"><li>The file or a script interpreter is not a regular file</li><li>Execute permission is denied for the file or a script</li><li>The filesystem is mounted <code>noexec</code></li><li>The file pathname or a script or ELF interpreter does not exist</li></ul> <p>For more information, see the <code>execve()</code> man page.</p>  |

The exit status of jobs is recorded in the PBS server logs and the accounting logs.

Negative exit status indicates that the job could not be executed. Negative exit values are listed in the table below:

**Table 11-2: Job Exit Codes**

| Exit Code | Name                              | Description   |
|-----------|-----------------------------------|---|
| 0         | <i>JOB_EXEC_OK</i>                | Job execution was successful  |
| -1        | <i>JOB_EXEC_FAIL1</i>             | Job execution failed, before files, no retry  |
| -2        | <i>JOB_EXEC_FAIL2</i>             | Job execution failed, after files, no retry   |
| -3        | <i>JOB_EXEC_RETRY</i>             | Job execution failed, do retry  |
| -4        | <i>JOB_EXEC_INITABT</i>           | Job aborted on MoM initialization   |
| -5        | <i>JOB_EXEC_INITRST</i>           | Job aborted on MoM initialization, checkpoint, no migrate   |
| -6        | <i>JOB_EXEC_INITRMG</i>           | Job aborted on MoM initialization, checkpoint, ok migrate   |
| -7        | <i>JOB_EXEC_BADRESRT</i>          | Job restart failed  |
| -10       | <i>JOB_EXEC_FAILUID</i>           | Invalid UID/GID for job   |
| -11       | <i>JOB_EXEC_RERUN</i>             | Job was rerun   |
| -12       | <i>JOB_EXEC_CHKP</i>              | Job was checkpointed and killed   |
| -13       | <i>JOB_EXEC_FAIL_PASSWORD</i>     | Job failed due to a bad password  |
| -14       | <i>JOB_EXEC_RERUN_ON_SIS_FAIL</i> | Job was requeued (if rerunnable) or deleted (if not) due to a communication failure between the primary execution host MoM and a Sister |
| -15       | <i>JOB_EXEC_QUEST</i>             | Requeue job for restart from checkpoint   |
| -16       | <i>JOB_EXEC_FAILHOOK_RERUN</i>    | Job execution failed due to hook rejection; requeue for later retry   |
| -17       | <i>JOB_EXEC_FAILHOOK_DELETE</i>   | Job execution failed due to hook rejection; delete the job at end   |
| -18       | <i>JOB_EXEC_HOOK_RERUN</i>        | A hook requested for job to be requeued   |
| -19       | <i>JOB_EXEC_HOOK_DELETE</i>       | A hook requested for job to be deleted  |
| -20       | <i>JOB_EXEC_RERUN_MS_FAIL</i>     | Job requeued because server couldn't contact the primary execution host MoM   |
| -21       | <i>JOB_EXEC_FAIL_SECURITY</i>     | Security breach in PBS directory  |
| -22       | <i>JOB_EXEC_HOOKERROR</i>         | Job execution failed due to unexpected exception or hook execution timeout  |
| -23       | <i>JOB_EXEC_FAIL_KRB5</i>         | Error no kerberos credentials supplied  |
| -24       | <i>JOB_EXEC_KILL_NCPUS_BURST</i>  | Job execution failed due to exceeding ncpus (burst)   |
| -25       | <i>JOB_EXEC_KILL_NCPUS_SUM</i>    | Job execution failed due to exceeding ncpus (sum)   |
| -26       | <i>JOB_EXEC_KILL_VMEM</i>         | Job execution failed due to exceeding vmem  |
| -27       | <i>JOB_EXEC_KILL_MEM</i>          | Job execution failed due to exceeding mem   |
| -28       | <i>JOB_EXEC_KILL_CPUT</i>         | Job execution failed due to exceeding cput  |
| -29       | <i>JOB_EXEC_KILL_WALLTIME</i>     | Job execution failed due to exceeding walltime  |

**Table 11-2: Job Exit Codes**

| <b>Exit Code</b> | <b>Name</b>               | <b>Description</b>  |
|------------------|---------------------------|---|
| -30              | JOB_EXEC_JOINJOB          | Job execution failed due to join job error                        |
| -31              | JOB_EXEC_KILL_HPMEM       | Job execution failed due to exceeding hpmem                       |
| -32              | JOB_EXEC_RERUN_ZOMBIE_JOB | Job execution hung due to re-imaged mom or lost job info from MoM |



# 12

## Example Configurations

This chapter shows some configuration-specific scenarios which will hopefully clarify any configuration questions. Several configuration models are discussed, followed by several examples of specific features.

Single Vnode System

Single Vnode System with Separate PBS server

Multi-vnode complex

Multi-level Route Queues (including group ACLs)

Multiple User ACLs

For each of these possible configuration models, the following information is provided:

General description for the configuration model

Type of system for which the model is well suited

Contents of server nodes file

Any required server configuration

Any required MoM configuration

Any required scheduler configuration

### 12.1 Single Vnode System

Running PBS on a single vnode/host as a standalone system is the least configuration. This model is most applicable to sites who have a single large server system. In this model, all PBS components run on the same host, which is the same host on which jobs will be executed. The following illustration shows how communication works when PBS is on a single host. For more on communication, see [Chapter 4, "Communication", on page 47](#).

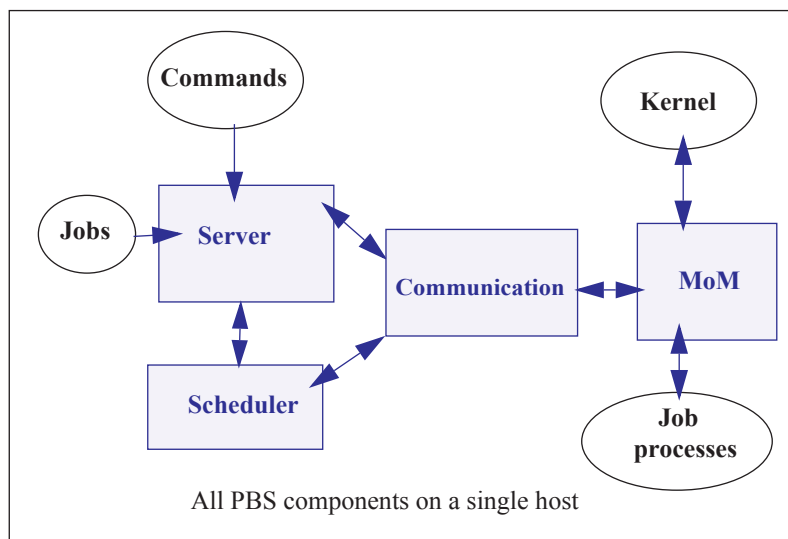


Figure 12-1: PBS daemons on a single execution host

For this example, let's assume we have a 32-CPU server machine named "mars". We want users to log into mars and jobs will be run via PBS on mars.

In this configuration, the server's default `nodes` file (which should contain the name of the host on which the server was installed) is sufficient. Our example `nodes` file would contain only one entry: `mars`

The default MoM and scheduler `config` files, as well as the default queue/Server limits are also sufficient in order to run jobs. No changes are required from the default configuration, however, you may wish to customize PBS to your site.

## 12.2 Separate Server and Execution Host

A variation on the model presented above would be to provide a "front-end" system that ran the PBS server, scheduler, and communication daemons, and from which users submitted their jobs. Only the MoM would run on our execution server, mars. This model is recommended when the user load would otherwise interfere with the computational load on the server. The following illustration shows how communication works when the PBS server and scheduler are on a front-end system and MoM is on a separate host. For more on communication, see [Chapter 4, "Communication", on page 47](#).

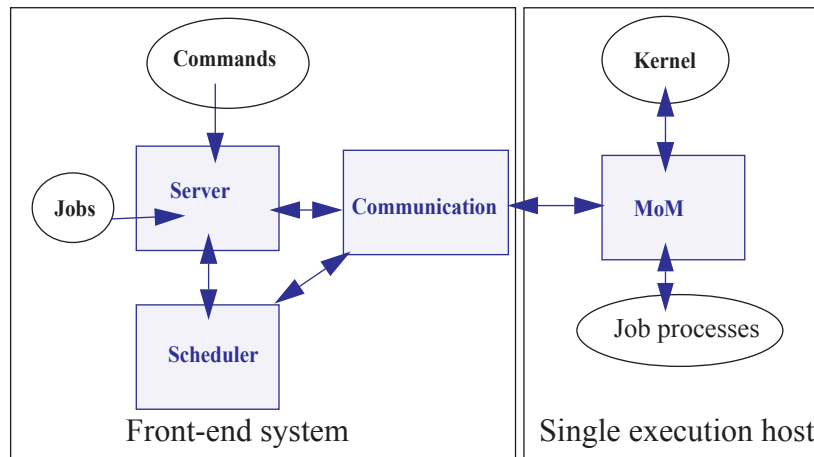


Figure 12-2: PBS daemons on single execution system with front end

In this case, the PBS `server_priv/nodes` file would contain the name of our execution server mars, but this may not be what was written to the file during installation, depending on which options were selected. It is possible the hostname of the machine on which the server was installed was added to the file, in which case you would need to use `qmgr (1B)` to manipulate the contents to contain one vnode: `mars`. If the default scheduling policy, based on available CPUs and memory, meets your requirements, no changes are required in either the MoM or scheduler configuration files.

However, if you wish the execution host (mars) to be scheduled based on load average, the following changes are needed. Edit MoM's `mom_priv/config` file so that it contains the target and maximum load averages:

```
$ideal_load 30
$max_load 32
```

## 12.3 Multiple Execution Hosts

The multi-vnode complex model is a very common configuration for PBS. In this model, there is typically a front-end system as we saw in the previous example, with a number of back-end execution hosts. The PBS server, scheduler, and communication daemons are typically run on the front-end system, and a MoM is run on each of the execution hosts, as shown in the diagram to the right.

In this model, the server's `nodes` file will need to contain the list of all the vnodes in the complex.

The following diagram illustrates an eight-host complex.

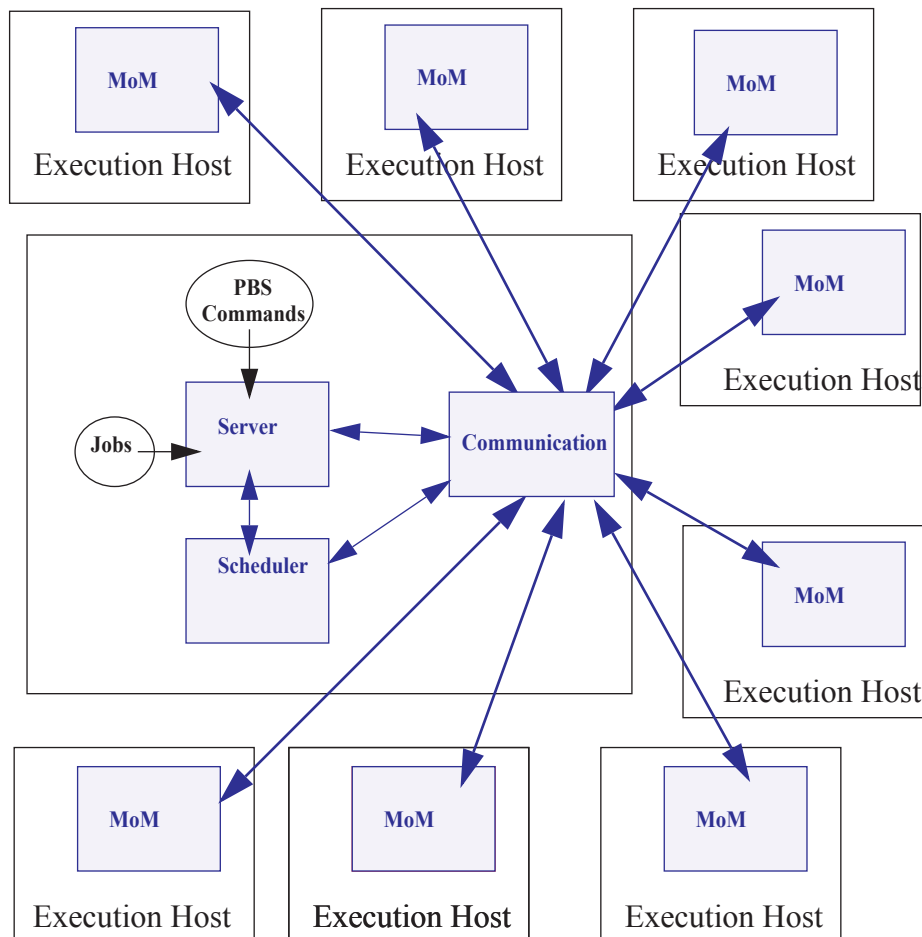


Figure 12-3: Typical PBS daemon locations for multiple execution hosts

This diagram illustrates a multi-vnode complex TPP configuration wherein the server and scheduler daemons communicate with the MoMs on the execution hosts via the communication daemon. Jobs are submitted to the server, scheduled for execution by the partition scheduler, and then transferred to a MoM when it's time to be run. MoM periodically sends status information back to the server, and answers resource requests from the scheduler.

## 12.4 Multi-level Route Queues

There are times when a site may wish to create a series of route queues in order to filter jobs, based on specific resources, or possibly to different destinations. For this example, consider a site that has two large server systems, and a Linux cluster. The Administrator wants to configure route queues such that everyone submits jobs to a single queue, but the jobs get routed based on (1) requested architecture and (2) individual group IDs. In other words, users request the architecture they want, and PBS finds the right queue for them. Only groups "math", "chemistry", and "physics" are permitted to use either server systems; while anyone can use the cluster. Lastly, the jobs coming into the cluster should be divided into three separate queues for long, short, and normal jobs. But the "long" queue was created for the astronomy department, so only members of that group should be permitted into that queue. Given these requirements, let's look at how we would set up such a collection of route queues. (Note that this is only one way to accomplish this task. There are various other ways too.)

First we create a queue to which everyone will submit their jobs. Let's call it "submit". It will need to be a route queue with three destinations, as shown:

```
Qmgr: create queue submit
Qmgr: set queue submit queue_type = Route
Qmgr: set queue submit route_destinations = server_1
Qmgr: set queue submit route_destinations += server_2
Qmgr: set queue submit route_destinations += cluster
Qmgr: set queue submit enabled = True
Qmgr: set queue submit started = True
```

Now we need to create the destination queues. (Notice in the above example, we have already decided what to call the three destinations: `server_1`, `server_2`, `cluster`.) First we create the `server_1` queue, complete with a group ACL, and a specific architecture limit.

```
Qmgr: create queue server_1
Qmgr: set queue server_1 queue_type = Execution
Qmgr: set queue server_1 from_route_only = True
Qmgr: set queue server_1 resources_max.arch = linux
Qmgr: set queue server_1 resources_min.arch = linux
Qmgr: set queue server_1 acl_group_enable = True
Qmgr: set queue server_1 acl_groups = math
Qmgr: set queue server_1 acl_groups += chemistry
Qmgr: set queue server_1 acl_groups += physics
Qmgr: set queue server_1 enabled = True
Qmgr: set queue server_1 started = True
```

Next we create the queues for `server_2` and `cluster`. Note that the `server_2` queue is very similar to the `server_1` queue, only the architecture differs. Also notice that the `cluster` queue is another route queue, with multiple destinations.

```
Qmgr: create queue server_2
Qmgr: set queue server_2 queue_type = Execution
Qmgr: set queue server_2 from_route_only = True
Qmgr: set queue server_2 resources_max.arch = sv2
Qmgr: set queue server_2 resources_min.arch = sv2
Qmgr: set queue server_2 acl_group_enable = True
Qmgr: set queue server_2 acl_groups = math
Qmgr: set queue server_2 acl_groups += chemistry
Qmgr: set queue server_2 acl_groups += physics
Qmgr: set queue server_2 enabled = True
Qmgr: set queue server_2 started = True
Qmgr: create queue cluster
Qmgr: set queue cluster queue_type = Route
Qmgr: set queue cluster from_route_only = True
Qmgr: set queue cluster resources_max.arch = linux
Qmgr: set queue cluster resources_min.arch = linux
Qmgr: set queue cluster route_destinations = long
Qmgr: set queue cluster route_destinations += short
Qmgr: set queue cluster route_destinations += medium
Qmgr: set queue cluster enabled = True
Qmgr: set queue cluster started = True
```



In the cluster queue above, you will notice the particular order of the three destination queues (`long`, `short`, `medium`). PBS will attempt to route a job into the destination queues in the order specified. Thus, we want PBS to first try the `long` queue (which will have an ACL on it), then the `short` queue (with its short time limits). Thus any jobs that had not been routed into any other queues (server or cluster) will end up in the `medium` cluster queue. Now to create the remaining queues.

```
Qmgr: create queue long
Qmgr: set queue long queue_type = Execution
Qmgr: set queue long from_route_only = True
Qmgr: set queue long resources_max.cput = 20:00:00
Qmgr: set queue long resources_max.walltime = 20:00:00
Qmgr: set queue long resources_min.cput = 02:00:00
Qmgr: set queue long resources_min.walltime = 03:00:00
Qmgr: set queue long acl_group_enable = True
Qmgr: set queue long acl_groups = astronomy
Qmgr: set queue long enabled = True
Qmgr: set queue long started = True

Qmgr: create queue short
Qmgr: set queue short queue_type = Execution
Qmgr: set queue short from_route_only = True
Qmgr: set queue short resources_max.cput = 01:00:00
Qmgr: set queue short resources_max.walltime = 01:00:00
Qmgr: set queue short enabled = True
Qmgr: set queue short started = True
Qmgr: create queue medium
Qmgr: set queue medium queue_type = Execution
Qmgr: set queue medium from_route_only = True
Qmgr: set queue medium enabled = True
Qmgr: set queue medium started = True
Qmgr: set server default_queue = submit
```

Notice that the `long` and `short` queues have time limits specified. This will ensure that jobs of certain sizes will enter (or be prevented from entering) these queues. The last queue, `medium`, has no limits, thus it will be able to accept any job that is not routed into any other queue.

Lastly, note the last line in the example above, which specified that the default queue is the new `submit` queue. This way users will simply submit their jobs with the resource and architecture requests, without specifying a queue, and PBS will route the job into the correct location. For example, if a user submitted a job with the following syntax, the job would be routed into the `server_2` queue:

```
qsub -l select=arch=sv2:ncpus=4 testjob
```

## 12.5 External Software License Management

PBS Professional can be configured to schedule jobs based on externally-controlled licensed software. A detailed example is provided in ["Example of Floating, Externally-managed License with Features" on page 274 in the PBS Professional Administrator's Guide](#).

---

## 12.6 Multiple User ACL Example

A site may have a need to restrict individual users to particular queues. In the previous example we set up queues with group-based ACLs, in this example we show user-based ACLs. Say a site has two different groups of users, and wants to limit them to two separate queues (perhaps with different resource limits). The following example illustrates this.

```
Qmgr: create queue structure
Qmgr: set queue structure queue_type = Execution
Qmgr: set queue structure acl_user_enable = True
Qmgr: set queue structure acl_users = curly
Qmgr: set queue structure acl_users += jerry
Qmgr: set queue structure acl_users += larry
Qmgr: set queue structure acl_users += moe
Qmgr: set queue structure acl_users += tom
Qmgr: set queue structure enabled = True
Qmgr: set queue structure started = True
```

```
Qmgr: create queue engine
Qmgr: set queue engine queue_type = Execution
Qmgr: set queue engine acl_user_enable = True
Qmgr: set queue engine acl_users = bill
Qmgr: set queue engine acl_users += bobby
Qmgr: set queue engine acl_users += chris
Qmgr: set queue engine acl_users += jim
Qmgr: set queue engine acl_users += mike
Qmgr: set queue engine acl_users += rob
Qmgr: set queue engine acl_users += scott
Qmgr: set queue engine enabled = True
Qmgr: set queue engine started = True
```

# Run Limit Error Messages

This chapter lists the error messages generated when limits are exceeded. See ["Managing Resource Usage By Users, Groups, and Projects, at Server & Queues"](#) on page 282 in the PBS Professional Administrator's Guide.

## 13.1 Run Limit Error Messages

When a job would exceed a limit by running, the job's comment field is set to one of the following messages. The following table shows the limit attribute, where the limit is applied, to whom the limit is applied, and the message.

**Table 13-1: Job Run Limit Error Messages**

| Attribute   | Where Applied | To What Applied  | Message  |
|-------------|---------------|------------------|--|
| max_run     | queue         | o: PBS_ALL       | Not Running: Queue <queue name> job limit has been reached.                  |
| max_run     | server        | o: PBS_ALL       | Not Running: Server job limit has been reached.                              |
| max_run     | server        | p:PBS_GENERIC    | Not Running: Project has reached server running limit.                       |
| max_run     | queue         | p:PBS_GENERIC    | Not Running: Project has reached queue<queue-name>'s running limit.          |
| max_run     | server        | p:<project name> | Not Running: Server job limit reached for project <project name>             |
| max_run     | queue         | p:<project name> | Not Running: Queue <queue-name> job limit reached for project <project name> |
| max_run     | queue         | g: PBS_GENERIC   | Not Running: Group has reached queue <queue name> running limit.             |
| max_run     | server        | g: PBS_GENERIC   | Not Running: Group has reached server running limit.                         |
| max_run     | queue         | u: PBS_GENERIC   | Not Running: User has reached queue <queue name> running job limit.          |
| max_run     | server        | u: PBS_GENERIC   | Not Running: User has reached server running job limit.                      |
| max_run     | queue         | g:<group name>   | Queue <queue name> job limit reached for group <G>                           |
| max_run     | server        | g:<group name>   | Server job limit reached for group <G>                                       |
| max_run     | queue         | u:<user name>    | Queue <queue name> job limit reached for user <U>                            |
| max_run     | server        | u:<user name>    | Server job limit reached for user <U>  |
| max_run_res | queue         | o: PBS_ALL       | Queue <queue name> job limit reached on resource <resource name>             |
| max_run_res | server        | o: PBS_ALL       | Server job limit reached on resource <resource name>                         |

Table 13-1: Job Run Limit Error Messages

| Attribute   | Where Applied | To What Applied  | Message  |
|-------------|---------------|------------------|--|
| max_run_res | queue         | p:PBS_GENERIC    | Not Running: Queue <queue name> per-project limit reached on resource <resource name>                      |
| max_run_res | server        | p:PBS_GENERIC    | Not Running: Server per-project limit reached on resource <resource name>                                  |
| max_run_res | server        | p:<project name> | Not Running: would exceed project <project_name>'s limit on resource <resource name> in complex            |
| max_run_res | queue         | p:<project name> | Not Running: would exceed project <project_name>'s limit on resource <resource name> in queue <queue-name> |
| max_run_res | queue         | g: PBS_GENERIC   | Queue <queue name> per-group limit reached on resource <resource name>                                     |
| max_run_res | server        | g: PBS_GENERIC   | Server per-group limit reached on resource <resource name>   |
| max_run_res | queue         | u: PBS_GENERIC   | Queue <queue name> per-user limit reached on resource <resource name>                                      |
| max_run_res | server        | u: PBS_GENERIC   | Server per-user limit reached on resource <resource name>  |
| max_run_res | queue         | g:<group name>   | would exceed group <G>'s limit on resource <resource name> in queue <queue name>                           |
| max_run_res | server        | g:<group name>   | would exceed group <G>'s limit on resource <resource name> in complex                                      |
| max_run_res | queue         | u:<user name>    | would exceed user <U>'s limit on resource <resource name> in queue <queue name>                            |
| max_run_res | server        | u:<user name>    | would exceed user <U>'s limit on resource <resource name> in complex                                       |

# 14

## Error Codes

The following table lists all the PBS error codes, their textual names, and a description of each.

**Table 14-1: Error Codes**

| Error Name     | Error Code | Description                            |
|----------------|------------|--|
| PBSE_NONE      | 0          | No error                               |
| PBSE_UNKJOBID  | 15001      | Unknown Job Identifier                 |
| PBSE_NOATTR    | 15002      | Undefined Attribute                    |
| PBSE_ATTRRO    | 15003      | Attempt to set READ ONLY attribute     |
| PBSE_IVALREQ   | 15004      | Invalid request                        |
| PBSE_UNKREQ    | 15005      | Unknown batch request                  |
| PBSE_TOOMANY   | 15006      | Too many submit retries                |
| PBSE_PERM      | 15007      | No permission                          |
| PBSE_BADHOST   | 15008      | Access from host not allowed           |
| PBSE_JOBEXIST  | 15009      | Job already exists                     |
| PBSE_SYSTEM    | 15010      | System error occurred                  |
| PBSE_INTERNAL  | 15011      | Internal server error occurred         |
| PBSE_REGROUTE  | 15012      | Parent job of dependent in route queue |
| PBSE_UNKSIG    | 15013      | Unknown signal name                    |
| PBSE_BADATVAL  | 15014      | Bad attribute value                    |
| PBSE_MODATTRUN | 15015      | Cannot modify attribute in run state   |
| PBSE_BADSTATE  | 15016      | Request invalid for job state          |
| PBSE_UNKQUE    | 15018      | Unknown queue name                     |
| PBSE_BADCRED   | 15019      | Invalid Credential in request          |
| PBSE_EXPIRED   | 15020      | Expired Credential in request          |
| PBSE_QUNOENB   | 15021      | Queue not enabled                      |
| PBSE_QACCESS   | 15022      | No access permission for queue         |

Table 14-1: Error Codes

| Error Name      | Error Code | Description  |
|-----------------|------------|--|
| PBSE_BADUSER    | 15023      | Missing userID, username, or GID. Returned under following conditions:<br>1. User does not have a password entry (getpwnam() returns null).<br>2. User's UID is zero and root isn't allowed to run jobs (acl_roots).<br>3. PBS_O_HOST is not set in the job. |
| PBSE_HOPCOUNT   | 15024      | Max hop count exceeded   |
| PBSE_QUEEEXIST  | 15025      | Queue already exists   |
| PBSE_ATTRTYPE   | 15026      | Incompatible queue attribute type  |
| PBSE_OBJBUSY    | 15027      | Object Busy  |
| PBSE_QUENBIG    | 15028      | Queue name too long  |
| PBSE_NOSUP      | 15029      | Feature/function not supported   |
| PBSE_QUENOEN    | 15030      | Can't enable queue, lacking definition   |
| PBSE_PROTOCOL   | 15031      | Protocol (ASN.1) error. Message is distorted or truncated.   |
| PBSE_BADATLST   | 15032      | Bad attribute list structure   |
| PBSE_NOCONNECTS | 15033      | No free connections  |
| PBSE_NOSERVER   | 15034      | No server to connect to  |
| PBSE_UNKRESC    | 15035      | Unknown resource   |
| PBSE_EXCQRESC   | 15036      | Job exceeds Queue resource limits  |
| PBSE_QUENODFLT  | 15037      | No Default Queue Defined   |
| PBSE_NORERUN    | 15038      | Job Not Rerunnable   |
| PBSE_ROUTEJ     | 15039      | Route rejected by all destinations   |
| PBSE_ROUTEEXP   | 15040      | Time in Route Queue Expired  |
| PBSE_MOMREJECT  | 15041      | Request to MoM failed  |
| PBSE_BADSCRIPT  | 15042      | (qsub) Cannot access script file   |
| PBSE_STAGEIN    | 15043      | Stage In of files failed   |
| PBSE_RESCUNAV   | 15044      | Resources temporarily unavailable  |
| PBSE_BADGRP     | 15045      | Bad Group specified  |
| PBSE_MAXQUED    | 15046      | Max number of jobs in queue  |
| PBSE_CKPBUSY    | 15047      | Checkpoint Busy, may be retries  |
| PBSE_EXLIMIT    | 15048      | Limit exceeds allowable  |
| PBSE_BADACCT    | 15049      | Bad Account attribute value  |
| PBSE_ALRDYEXIT  | 15050      | Job already in exit state  |

Table 14-1: Error Codes

| Error Name                          | Error Code | Description   |
|-------------------------------------|------------|---|
| PBSE_NOCOPYFILE                     | 15051      | Job files not copied  |
| PBSE_CLEANEDOUT                     | 15052      | Unknown job id after clean init                                 |
| PBSE_NOSYNCMSTR                     | 15053      | No Master in Sync Set   |
| PBSE_BADDEPEND                      | 15054      | Invalid dependency  |
| PBSE_DUPLIST                        | 15055      | Duplicate entry in List   |
| PBSE_DISPROTO                       | 15056      | Bad DIS based Request Protocol                                  |
| PBSE_EXECUTHERE ( <b>Obsolete</b> ) | 15057      | Cannot execute there<br>(Obsolete; no longer used.)             |
| PBSE_SISREJECT                      | 15058      | Sister rejected   |
| PBSE_SISCOMM                        | 15059      | Sister could not communicate                                    |
| PBSE_SVRDOWN                        | 15060      | Request rejected -server shutting down                          |
| PBSE_CKPSHORT                       | 15061      | Not all tasks could checkpoint                                  |
| PBSE_UNKNODE                        | 15062      | Named vnode is not in the list                                  |
| PBSE_UNKNODEATR                     | 15063      | Vnode attribute not recognized                                  |
| PBSE_NONODES                        | 15064      | Server has no vnode list  |
| PBSE_NODENBIG                       | 15065      | Node name is too big  |
| PBSE_NODEEXIST                      | 15066      | Node name already exists  |
| PBSE_BADNDATVAL                     | 15067      | Bad vnode attribute value                                       |
| PBSE_MUTUALEX                       | 15068      | State values are mutually exclusive                             |
| PBSE_GMODERR                        | 15069      | Error(s) during global mod of vnodes                            |
| PBSE_NORELYMOM                      | 15070      | Could not contact MoM   |
| PBSE_REV_NO_WALLTIME                | 15075      | Reservation lacks walltime                                      |
| Reserved                            | 15076      | Not used.   |
| PBSE_TOOLATE                        | 15077      | Reservation submitted with a start time that has already passed |
| PBSE_IRESVE                         | 15078      | Internal reservation system error                               |
| PBSE_UNKRESVTYPE                    | 15079      | Unknown reservation type  |
| PBSE_RESVEXIST                      | 15080      | Reservation already exists                                      |
| PBSE_resvFail                       | 15081      | Reservation failed  |
| PBSE_genBatchReq                    | 15082      | Batch request generation failed                                 |
| PBSE_mgrBatchReq                    | 15083      | qmgr batch request failed                                       |
| PBSE_UNKRESVID                      | 15084      | Unknown reservation ID  |
| PBSE_delProgress                    | 15085      | Delete already in progress                                      |

Table 14-1: Error Codes

| Error Name                 | Error Code | Description                           |
|----------------------------|------------|---------------------------------------|
| PBSE_BADTSPEC              | 15086      | Bad time specification(s)             |
| PBSE_RESVMSG               | 15087      | So reply_text can return a msg        |
| PBSE_BADNODESPEC           | 15089      | Node(s) specification error           |
| PBSE_LICENSEINV            | 15091      | License is invalid                    |
| PBSE_RESVAUTH_H            | 15092      | Host not authorized to make AR        |
| PBSE_RESVAUTH_G            | 15093      | Group not authorized to make AR       |
| PBSE_RESVAUTH_U            | 15094      | User not authorized to make AR        |
| PBSE_R_UID                 | 15095      | Bad effective UID for reservation     |
| PBSE_R_GID                 | 15096      | Bad effective GID for reservation     |
| PBSE_IBMSPSWITCH           | 15097      | IBM SP Switch error                   |
| PBSE_NOSCHEDULER           | 15099      | Unable to contact scheduler           |
| PBSE_RESCNOTSTR            | 15100      | Resource is not of type string        |
| PBSE_MaxArraySize          | 15107      | max array size exceeded               |
| PBSE_INVALELECTRESC        | 15108      | resource invalid in select spec       |
| PBSE_INVALJOBRESC          | 15109      | invalid job resource                  |
| PBSE_INVALNODEPLACE        | 15110      | node invalid w/place select           |
| PBSE_PLACENOSELECT         | 15111      | cannot have place w/o select          |
| PBSE_INDIRECTHOP           | 15112      | too many indirect resource levels     |
| PBSE_INDIRECTBT            | 15113      | target resource undefined             |
| PBSE_NGBLUEGENE            | 15114      | No node_group_enable on BlueGene      |
| PBSE_NODESTALE             | 15115      | Cannot change state of stale vnode    |
| PBSE_DUPRESC               | 15116      | cannot dupe resource within a chunk   |
| PBSE_CONNFULL              | 15117      | server connection table full          |
| PBSE_LICENSE_MIN_BADVAL    | 15118      | bad value for pbs_license_min         |
| PBSE_LICENSE_MAX_BADVAL    | 15119      | bad value for pbs_license_max         |
| PBSE_LICENSE_LINGER_BADVAL | 15120      | bad value for pbs_license_linger_time |
| PBSE_LICENSE_BAD_ACTION    | 15122      | Not allowed action with licensing     |
| PBSE_BAD_FORMULA           | 15123      | invalid sort formula                  |
| PBSE_BAD_FORMULA_KW        | 15124      | invalid keyword in formula            |
| PBSE_BAD_FORMULA_TYPE      | 15125      | invalid resource type in formula      |
| PBSE_BAD_RRULE_YEARLY      | 15126      | reservation duration exceeds 1 year   |
| PBSE_BAD_RRULE_MONTHLY     | 15127      | reservation duration exceeds 1 month  |



Table 14-1: Error Codes

| Error Name                            | Error Code | Description   |
|---------------------------------------|------------|---|
| PBSE_BAD_RRULE_WEEKLY                 | 15128      | reservation duration exceeds 1 week   |
| PBSE_BAD_RRULE_DAILY                  | 15129      | reservation duration exceeds 1 day  |
| PBSE_BAD_RRULE_HOURLY                 | 15130      | reservation duration exceeds 1 hour   |
| PBSE_BAD_RRULE_MINUTELY               | 15131      | reservation duration exceeds 1 minute   |
| PBSE_BAD_RRULE_SECONDLY               | 15132      | reservation duration exceeds 1 second   |
| PBSE_BAD_RRULE_SYNTAX                 | 15133      | invalid recurrence rule syntax  |
| PBSE_BAD_RRULE_SYNTAX2                | 15134      | invalid recurrence rule syntax  |
| PBSE_BAD_ICAL_TZ                      | 15135      | Undefined timezone info directory   |
| PBSE_HOOKERROR                        | 15136      | error encountered related to hooks  |
| PBSE_NEEDQUET                         | 15137      | need queue type set   |
| PBSE_ETEERROR                         | 15138      | not allowed to alter attribute when <code>eligible_time_enable</code> is off                                    |
| PBSE_HISTJOBID                        | 15139      | History job ID  |
| PBSE_JOBHISTNOTSET                    | 15140      | <code>job_history_enable</code> not SET   |
| PBSE_MIXENTLIMS                       | 15141      | mixing old and new limit enforcement  |
| PBSE_HEADERROR                        | 15145      | Server host not allowed to be provisioned   |
| PBSE_NODEPROV_NOACTION                | 15146      | While provisioning, provisioning attributes can't be modified   |
| PBSE_NODEPROV                         | 15147      | State of provisioning vnode can't be changed  |
| PBSE_NODEPROV_NODEL                   | 15148      | Vnode can't be deleted while provisioning   |
| PBSE_NODE_BAD_CURRENT_AOE             | 15149      | Attempt to set an AOE that is not in <code>resources_available.aoe</code>                                       |
| PBSE_NOTLOCALNODE                     | 15150      | Non-local node not allowed in Personal Mode (not used)  |
| PBSE_MOM_INCOMPLETE_HOOK              | 15167      | Execution hooks not fully transferred to a particular MoM   |
| PBSE_MOM_REJECT_ROOT_SCRIPTS          | 15168      | A MoM has rejected a request to copy a hook-related file, or a job script to be executed by root                |
| PBSE_HOOK_REJECT                      | 15169      | A MoM received a reject result from a mom hook  |
| PBSE_HOOK_REJECT_RERUNJOB             | 15170      | Hook rejection requiring a job to be rerun  |
| PBSE_HOOK_REJECT_DELETEJOB            | 15171      | Hook rejection requiring a job to be deleted  |
| PBSE_JOBNBIG                          | 15173      | Submitted job or reservation name is too long   |
|                                       | 15178      | Cannot alter start time of running, non-empty reservation   |
|                                       | 15179      | Cannot alter current or next occurrence of a standing reservation so that it interferes with a later occurrence |
| Resource monitor specific error codes |            |   |
| PBSE_RMUNKNOWN                        | 15201      | Resource unknown  |

Table 14-1: Error Codes

| Error Name                   | Error Code | Description  |
|------------------------------|------------|--|
| PBSE_RMBADPARAM              | 15202      | Parameter could not be used                        |
| PBSE_RMNOPARAM               | 15203      | A needed parameter did not exist                   |
| PBSE_RMEXIST                 | 15204      | Something specified didn't exist                   |
| PBSE_RMSYSTEM                | 15205      | A system error occurred                            |
| PBSE_RMPART                  | 15206      | Only part of reservation made                      |
| PBSE_SSIGNON_BAD_TRANSITION2 | 15207      | bad attempt: false to true                         |
| PBSE_TRYAGAIN                | 15208      | Try the request again later                        |
| PBSE_ALPSRELERR              | 15209      | PBS is unable to release the ALPS reservation      |
| PBSE_NOTARRAY_ATTR           | 15231      | Attempt to set max_run_subjobs for a non-array job |

# 15

## Request Codes

When reading the PBS event logfiles, you may see messages of the form "Type 19 request received from PBS\_Server...". These "type codes" correspond to different PBS batch requests. The following table lists all the PBS type codes and the corresponding request of each.

**Table 15-1: Request Codes**

| <b>Numeric Value</b> | <b>Name</b>           |
|----------------------|-----------------------|
| 0                    | PBS_BATCH_Connect     |
| 1                    | PBS_BATCH_QueueJob    |
| 2                    | UNUSED                |
| 3                    | PBS_BATCH_jobscript   |
| 4                    | PBS_BATCH_RdytoCommit |
| 5                    | PBS_BATCH_Commit      |
| 6                    | PBS_BATCH_DeleteJob   |
| 7                    | PBS_BATCH_HoldJob     |
| 8                    | PBS_BATCH_LocateJob   |
| 9                    | PBS_BATCH_Manager     |
| 10                   | PBS_BATCH_MessJob     |
| 11                   | PBS_BATCH_ModifyJob   |
| 12                   | PBS_BATCH_MoveJob     |
| 13                   | PBS_BATCH_ReleaseJob  |
| 14                   | PBS_BATCH_Rerun       |
| 15                   | PBS_BATCH_RunJob      |
| 16                   | PBS_BATCH_SelectJobs  |
| 17                   | PBS_BATCH_Shutdown    |
| 18                   | PBS_BATCH_SignalJob   |
| 19                   | PBS_BATCH_StatusJob   |
| 20                   | PBS_BATCH_StatusQue   |
| 21                   | PBS_BATCH_StatusSvr   |
| 22                   | PBS_BATCH_TrackJob    |
| 23                   | PBS_BATCH_AsyrunJob   |
| 24                   | PBS_BATCH_Rescq       |
| 25                   | PBS_BATCH_ReserveResc |

**Table 15-1: Request Codes**

| <b>Numeric Value</b> | <b>Name</b>              |
|----------------------|--------------------------|
| 26                   | PBS_BATCH_ReleaseResc    |
| 27                   | PBS_BATCH_FailOver       |
| 48                   | PBS_BATCH_StageIn        |
| 49                   | PBS_BATCH_AuthenUser     |
| 50                   | PBS_BATCH_OrderJob       |
| 51                   | PBS_BATCH_SelStat        |
| 52                   | PBS_BATCH_RegistDep      |
| 54                   | PBS_BATCH_CopyFiles      |
| 55                   | PBS_BATCH_DelFiles       |
| 56                   | PBS_BATCH_JobObit        |
| 57                   | PBS_BATCH_MvJobFile      |
| 58                   | PBS_BATCH_StatusNode     |
| 59                   | PBS_BATCH_Disconnect     |
| 60                   | UNUSED                   |
| 61                   | UNUSED                   |
| 62                   | PBS_BATCH_JobCred        |
| 63                   | PBS_BATCH_CopyFiles_Cred |
| 64                   | PBS_BATCH_DelFiles_Cred  |
| 65                   | PBS_BATCH_GSS_Context    |
| 66                   | UNUSED                   |
| 67                   | UNUSED                   |
| 68                   | UNUSED                   |
| 69                   | UNUSED                   |
| 70                   | PBS_BATCH_SubmitResv     |
| 71                   | PBS_BATCH_StatusResv     |
| 72                   | PBS_BATCH_DeleteResv     |
| 73                   | PBS_BATCH_UserCred       |
| 74                   | PBS_BATCH_UserMigrate    |
| 75                   | PBS_BATCH_ConfirmResv    |
| 80                   | PBS_BATCH_DefSchReply    |
| 81                   | PBS_BATCH_StatusSched    |
| 82                   | PBS_BATCH_StatusRsc      |
| 83                   | PBS_BATCH_StatusHook     |

**Table 15-1: Request Codes**

| <b>Numeric Value</b> | <b>Name</b>               |
|----------------------|---------------------------|
| 84                   | PBS_BATCH_PySpawn         |
| 85                   | PBS_BATCH_CopyHookFile    |
| 86                   | PBS_BATCH_DelHookFile     |
| 87                   | PBS_BATCH_MomRestart      |
| 88                   | PBS_BATCH_AuthExternal    |
| 89                   | PBS_BATCH_HookPeriodic    |
| 90                   | PBS_BATCH_RelnodesJob     |
| 91                   | PBS_BATCH_ModifyResv      |
| 92                   | PBS_BATCH_ResvOccurEnd    |
| 93                   | PBS_BATCH_PreemptJobs     |
| 94                   | PBS_BATCH_Cred            |
| 95                   | PBS_BATCH_Authenticate    |
| 96                   | PBS_BATCH_ModifyJob_Async |
| 98                   | PBS_BATCH_RegisterSched   |
| 99                   | PBS_BATCH_ModifyVnode     |



# PBS Environment Variables

The following table lists the PBS environment variables:

**Table 16-1: PBS Environment Variables**

| Variable                    | Origin        | Meaning  |
|-----------------------------|---------------|--|
| CONTAINER_IMAGE             | Job submitter | Name of container image in which job is to run   |
| NCPUS                       |               | Number of threads, defaulting to number of CPUs, on the vnode  |
| NEC_PROCESS_DIST            | Job submitter | For NEC SX-Aurora TSUBASA. Specifies process distribution. See <a href="#">"Specifying Process Distribution", on page 208 of the PBS Professional User's Guide</a> .   |
| OMP_NUM_THREADS             |               | Same as NCPUS.   |
| PBS_ARRAY_ID                | Server        | Identifier for job arrays. Consists of sequence number.  |
| PBS_ARRAY_INDEX             | Server        | Index number of subjob in job array.   |
| PBS_CGROUP_CONFIG_COPY_FILE |               | Tells MoM to copy the specified container configuration file to <code>\$PBS_HOM/mom_priv/pbs_cgroups.json</code> on the execution host.<br>Available during installation only.<br>Overridden by <code>PBS_CGROUP_CONFIG_SYMLINK</code> .<br>See <a href="#">"Providing a Cgroups Configuration File to MoM" on page 320 in the PBS Professional Administrator's Guide</a>                              |
| PBS_CGROUP_CONFIG_SYMLINK   |               | Tells MoM to create a symlink to the specified cgroup configuration file, and put the symlink in <code>\$PBS_HOM/mom_priv/pbs_cgroups.json</code> on the execution host.<br>Available during installation only.<br>Overrides <code>PBS_CGROUP_CONFIG_COPY_FILE</code><br>See <a href="#">"Providing a Cgroups Configuration File to MoM" on page 320 in the PBS Professional Administrator's Guide</a> |
| PBS_CONF_FILE               |               | Path to <code>pbs.conf</code>  |
| PBS_CONTAINER_ARGS          | Job submitter | Arguments to pass to container engine. Multiple arguments are separated with a semicolon. When using this environment variable, the <code>-env</code> and <code>--entrypoint</code> arguments to <code>docker run</code> are not supported. To pass environment variables directly to PBS, use <code>qsub -v</code> .  |

Table 16-1: PBS Environment Variables

| Variable                       | Origin                     | Meaning   |
|--------------------------------|----------------------------|---|
| PBS_CONTAINER_CONFIG_COPY_FILE |                            | <p>Tells MoM to copy the specified container configuration file to \$PBS_HOM/mom_priv/pbs_containers.json on the execution host.</p> <p>Available during installation only.</p> <p>See <a href="#">"Providing a Container Configuration File to MoM" on page 362 in the PBS Professional Administrator's Guide</a></p>                                    |
| PBS_CONTAINER_CONFIG_SYMLINK   |                            | <p>Tells MoM to create a symlink to the specified container configuration file, and put the symlink in \$PBS_HOM/mom_priv/pbs_containers.json on the execution host</p> <p>Available during installation only.</p> <p>See <a href="#">"Providing a Container Configuration File to MoM" on page 362 in the PBS Professional Administrator's Guide</a></p> |
| PBS_DATA_SERVICE_USER          | Admin, during installation | Account used by data service.   |
| PBS_DEFAULT                    |                            | Name of default PBS server  |
| PBS_ENVIRONMENT                |                            | Indicates job type: <i>PBS_BATCH</i> or <i>PBS_INTERACTIVE</i>  |
| PBS_GPU_CONFIG_COPY_FILE       |                            | <p>Tells MoM to copy the specified container configuration file to \$PBS_HOM/mom_priv/pbs_gpus.json on the execution host.</p> <p>Available during installation only.</p> <p>See <a href="#">"Providing a GPU Configuration File to MoM" on page 349 in the PBS Professional Administrator's Guide</a></p>  |
| PBS_GPU_CONFIG_SYMLINK         |                            | <p>Tells MoM to create a symlink to the specified container configuration file, and put the symlink in \$PBS_HOM/mom_priv/pbs_gpus.json on the execution host.</p> <p>Available during installation only.</p> <p>See <a href="#">"Providing a GPU Configuration File to MoM" on page 349 in the PBS Professional Administrator's Guide</a></p>            |
| PBS_JOBCOOKIE                  |                            | Unique identifier for inter-MoM job-based communication.  |
| PBS_JOBDIR                     |                            | Pathname of job-specific staging and execution directory  |
| PBS_JOBID                      | Server                     | The job identifier assigned to the job or job array by the batch system.  |
| PBS_JOBNAME                    | User                       | The job name supplied by the user.  |



Table 16-1: PBS Environment Variables

| Variable                  | Origin                             | Meaning  |
|---------------------------|------------------------------------|--|
| PBS_LICENSE_INFO          | Admin                              | Location of license server   |
| PBS_LOG_HIGHRES_TIMESTAMP |                                    | Controls whether daemons on this host log timestamps in microseconds.<br><br>Default timestamp log format is <i>HH:MM:SS</i> . With microsecond logging, format is <i>HH:MM:SS:XXXXXX</i> .<br><br>Does not affect accounting log. Not applicable when using <code>syslog</code> .<br><br>Overrides configuration parameter in <code>pbs.conf</code> of the same name.<br><br>Valid values: <i>0</i> , <i>1</i> . Default: <i>0</i> (no microsecond logging) |
| PBS_MOMPORT               |                                    | Port number on which this job's MoMs will communicate.   |
| PBS_NODEFILE              |                                    | The filename containing a list of vnodes assigned to the job.  |
| PBS_NODENUM               |                                    | Index into <code>\$PBS_NODEFILE</code> . Starts at zero.   |
| PBS_O_HOME                | Submission environment             | Value of <code>HOME</code> from submission environment.  |
| PBS_O_HOST                | Submission environment; set by PBS | The host name on which the <code>qsub</code> command was executed.   |
| PBS_O_LANG                | Submission environment             | Value of <code>LANG</code> from submission environment   |
| PBS_O_LOGNAME             | Submission environment             | Value of <code>LOGNAME</code> from submission environment  |
| PBS_O_MAIL                | Submission environment             | Value of <code>MAIL</code> from submission environment   |
| PBS_O_PATH                | Submission environment             | Value of <code>PATH</code> from submission environment   |
| PBS_O_QUEUE               | Submission environment             | The original queue name to which the job was submitted.  |
| PBS_O_SHELL               | Submission environment             | Value of <code>SHELL</code> from submission environment  |
| PBS_O_SYSTEM              | Submission environment             | The operating system name where <code>qsub</code> was executed.  |
| PBS_O_TZ                  | Submission environment             | Value of <code>TZ</code> from submission environment   |
| PBS_O_WORKDIR             | Submission environment             | The absolute path of directory where <code>qsub</code> was executed.   |
| PBS_QUEUE                 |                                    | The name of the queue from which the job is executed.  |
| PBS_SCHED_THREADS         |                                    | Maximum number of scheduler threads. Scheduler automatically caps number of threads at the number of cores (or hyperthreads if applicable), regardless of value of this variable.<br><br>Overridden by <code>pbs_sched -t</code> option. Overrides <code>PBS_SCHED_THREADS</code> parameter in <code>pbs.conf</code> .<br><br>Default: 1   |
| PBS_SERVER                | Submission environment             | The name of the default PBS server.  |
| PBS_SID                   |                                    | Session ID   |

Table 16-1: PBS Environment Variables

| Variable    | Origin | Meaning   |
|-------------|--------|---|
| PBS_TASKNUM |        | The task (process) number for the job on this vnode.    |
| PBS_TMPDIR  |        | Root of temporary directories/files for PBS components. |
| TMPDIR      |        | The job-specific temporary directory for this job.      |

# 17

## File Listing

The following table lists all the PBS files and directories; owner and permissions are specific to Linux systems.

**Table 17-1: File Listing**

| Directory / File   | Owner | Permission | Average Size |
|--|-------|------------|--------------|
| /opt/pbs/default/etc/pbs_bootcheck.py  | root  | -rw-r--r-- | 4111         |
| /var/tmp/pbs_bootcheck.py  | root  | -rw-r--r-- | 4111         |
| /var/tmp/pbs_boot_check<br>See <a href="#">"Discovering Last Reboot Time of Server" on page 455 in the PBS Professional Administrator's Guide.</a> | root  | -rw-r--r-- | 188          |
| PBS_EXEC/  | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/bin   | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/bin/pbsdsh  | root  | -rwxr-xr-x | 111837       |
| PBS_EXEC/bin/pbsnodes  | root  | -rwxr-xr-x | 153004       |
| PBS_EXEC/bin/pbs_dataservice   | root  | -rwx-----  |              |
| PBS_EXEC/bin/pbs_hostn   | root  | -rwxr-xr-x | 35493        |
| PBS_EXEC/bin/pbs_rdel  | root  | -rwxr-xr-x | 151973       |
| PBS_EXEC/bin/pbs_rstat   | root  | -rwxr-xr-x | 156884       |
| PBS_EXEC/bin/pbs_rsub  | root  | -rwxr-xr-x | 167446       |
| PBS_EXEC/bin/pbs_tclsh   | root  | -rwxr-xr-x | 857552       |
| PBS_EXEC/bin/pbs_wish  | root  | -rwxr-xr-x | 1592236      |
| PBS_EXEC/bin/printjob  | root  | -rwxr-xr-x | 42667        |
| PBS_EXEC/bin/qalter  | root  | -rwxr-xr-x | 210723       |
| PBS_EXEC/bin/qdel  | root  | -rwxr-xr-x | 164949       |
| PBS_EXEC/bin/qdisable  | root  | -rwxr-xr-x | 139559       |
| PBS_EXEC/bin/qenable   | root  | -rwxr-xr-x | 139558       |
| PBS_EXEC/bin/qhold   | root  | -rwxr-xr-x | 165368       |
| PBS_EXEC/bin/qmgr  | root  | -rwxr-xr-x | 202526       |
| PBS_EXEC/bin/qmove   | root  | -rwxr-xr-x | 160932       |
| PBS_EXEC/bin/qmsg  | root  | -rwxr-xr-x | 160408       |
| PBS_EXEC/bin/qorder  | root  | -rwxr-xr-x | 146393       |
| PBS_EXEC/bin/qrerun  | root  | -rwxr-xr-x | 157228       |

Table 17-1: File Listing

| Directory / File                      | Owner | Permission | Average Size |
|---------------------------------------|-------|------------|--------------|
| PBS_EXEC/bin/qrls                     | root  | -rwxr-xr-x | 165361       |
| PBS_EXEC/bin/qrun                     | root  | -rwxr-xr-x | 160978       |
| PBS_EXEC/bin/qselect                  | root  | -rwxr-xr-x | 163266       |
| PBS_EXEC/bin/qsig                     | root  | -rwxr-xr-x | 160083       |
| PBS_EXEC/bin/qstart                   | root  | -rwxr-xr-x | 139589       |
| PBS_EXEC/bin/qstat                    | root  | -rwxr-xr-x | 207532       |
| PBS_EXEC/bin/qstop                    | root  | -rwxr-xr-x | 139584       |
| PBS_EXEC/bin/qsub                     | root  | -rwxr-xr-x | 275460       |
| PBS_EXEC/bin/qterm                    | root  | -rwxr-xr-x | 132188       |
| PBS_EXEC/bin/tracejob                 | root  | -rwxr-xr-x | 64730        |
| PBS_EXEC/etc                          | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/etc/modulefile               | root  | -rw-r--r-- | 749          |
| PBS_EXEC/etc/pbs_db_schema.sql        | root  | -rw-r--r-- | 10522        |
| PBS_EXEC/etc/pbs_dedicated            | root  | -rw-r--r-- | 557          |
| PBS_EXEC/etc/pbs_holidays             | root  | -rw-r--r-- | 2612         |
| PBS_EXEC/etc/pbs_holidays.<year>      | root  | -rw-r--r-- | 2643         |
| PBS_EXEC/etc/pbs_resource_group       | root  | -rw-r--r-- | 657          |
| PBS_EXEC/etc/pbs_sched_config         | root  | -r--r--r-- | 9791         |
| PBS_EXEC/include                      | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/include/pbs_error.h          | root  | -r--r--r-- | 7543         |
| PBS_EXEC/include/pbs_ifl.h            | root  | -r--r--r-- | 17424        |
| PBS_EXEC/include/rm.h                 | root  | -r--r--r-- | 740          |
| PBS_EXEC/include/tm.h                 | root  | -r--r--r-- | 2518         |
| PBS_EXEC/include/tm_.h                | root  | -r--r--r-- | 2236         |
| PBS_EXEC/lib                          | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/lib/libattr.a                | root  | -rw-r--r-- | 390274       |
| PBS_EXEC/lib/liblog.a                 | root  | -rw-r--r-- | 101230       |
| PBS_EXEC/lib/libnet.a                 | root  | -rw-r--r-- | 145968       |
| PBS_EXEC/lib/libpbs.a                 | root  | -rw-r--r-- | 1815486      |
| PBS_EXEC/lib/libsite.a                | root  | -rw-r--r-- | 132906       |
| PBS_EXEC/lib/MPI                      | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/lib/MPI/pbsrun.ch_gm.init.in | root  | -rw-r--r-- | 9924         |

Table 17-1: File Listing

| Directory / File                         | Owner | Permission | Average Size |
|--|-------|------------|--------------|
| PBS_EXEC/lib/MPI/pbsrun.ch_mx.init.in    | root  | -rw-r--r-- | 9731         |
| PBS_EXEC/lib/MPI/pbsrun.gm_mpd.init.in   | root  | -rw-r--r-- | 10767        |
| PBS_EXEC/lib/MPI/pbsrun.intelmpi.init.in | root  | -rw-r--r-- | 10634        |
| PBS_EXEC/lib/MPI/pbsrun.mpich2.init.in   | root  | -rw-r--r-- | 10694        |
| PBS_EXEC/lib/MPI/pbsrun.mx_mpd.init.in   | root  | -rw-r--r-- | 10770        |
| PBS_EXEC/lib/MPI/sgimPI.awk              | root  | -rw-r--r-- | 6564         |
| PBS_EXEC/lib/pbs_sched.a                 | root  | -rw-r--r-- | 822026       |
| PBS_EXEC/lib/pm                          | root  | drwxr--r-- | 4096         |
| PBS_EXEC/lib/pm/PBS.pm                   | root  | -rw-r--r-- | 3908         |
| PBS_EXEC/libexec/au-nodeupdate.pl        | root  | -rw-r--r-- |              |
| PBS_EXEC/libexec/install_db              | root  | -rwx-----  | 10506        |
| PBS_EXEC/libexec/pbs_habitat             | root  | -rwx-----  | 10059        |
| PBS_EXEC/libexec/pbs_init.d              | root  | -rwx-----  | 25568        |
| PBS_EXEC/libexec/pbs_postinstall         | root  | -rwx-----  | 29104        |
| PBS_EXEC/share/man                       | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/share/man/man1                  | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/share/man/man1/pbs.1B           | root  | -rw-r--r-- | 5376         |
| PBS_EXEC/share/man/man1/pbsdsh.1B        | root  | -rw-r--r-- | 2978         |
| PBS_EXEC/share/man/man1/pbs_ralter.1B    | root  | -rw-r--r-- |              |
| PBS_EXEC/share/man/man1/pbs_rdel.1B      | root  | -rw-r--r-- | 2342         |
| PBS_EXEC/share/man/man1/pbs_rstat.1B     | root  | -rw-r--r-- | 2682         |
| PBS_EXEC/share/man/man1/pbs_rsub.1B      | root  | -rw-r--r-- | 9143         |
| PBS_EXEC/share/man/man1/qalter.1B        | root  | -rw-r--r-- | 21569        |
| PBS_EXEC/share/man/man1/qdel.1B          | root  | -rw-r--r-- | 3363         |
| PBS_EXEC/share/man/man1/qhold.1B         | root  | -rw-r--r-- | 4323         |
| PBS_EXEC/share/man/man1/qmove.1B         | root  | -rw-r--r-- | 3343         |
| PBS_EXEC/share/man/man1/qmsg.1B          | root  | -rw-r--r-- | 3244         |
| PBS_EXEC/share/man/man1/qorder.1B        | root  | -rw-r--r-- | 3028         |
| PBS_EXEC/share/man/man1/qrerun.1B        | root  | -rw-r--r-- | 2965         |
| PBS_EXEC/share/man/man1/qrls.1B          | root  | -rw-r--r-- | 3927         |
| PBS_EXEC/share/man/man1/qselect.1B       | root  | -rw-r--r-- | 12690        |
| PBS_EXEC/share/man/man1/qsig.1B          | root  | -rw-r--r-- | 3817         |

Table 17-1: File Listing

| Directory / File                                | Owner | Permission | Average Size |
|---|-------|------------|--------------|
| PBS_EXEC/share/man/man1/qstat.1B                | root  | -rw-r--r-- | 15274        |
| PBS_EXEC/share/man/man1/qsub.1B                 | root  | -rw-r--r-- | 36435        |
| PBS_EXEC/share/man/man3                         | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/share/man/man3/pbs_alterjob.3B         | root  | -rw-r--r-- | 5475         |
| PBS_EXEC/share/man/man3/pbs_connect.3B          | root  | -rw-r--r-- | 3493         |
| PBS_EXEC/share/man/man3/pbs_default.3B          | root  | -rw-r--r-- | 2150         |
| PBS_EXEC/share/man/man3/pbs_deljob.3B           | root  | -rw-r--r-- | 3081         |
| PBS_EXEC/share/man/man3/pbs_disconnect.3B       | root  | -rw-r--r-- | 1985         |
| PBS_EXEC/share/man/man3/pbs_geterrmsg.3B        | root  | -rw-r--r-- | 2473         |
| PBS_EXEC/share/man/man3/pbs_holdjob.3B          | root  | -rw-r--r-- | 3006         |
| PBS_EXEC/share/man/man3/pbs_manager.3B          | root  | -rw-r--r-- | 4337         |
| PBS_EXEC/share/man/man3/pbs_movejob.3B          | root  | -rw-r--r-- | 3220         |
| PBS_EXEC/share/man/man3/pbs_msgjob.3B           | root  | -rw-r--r-- | 2912         |
| PBS_EXEC/share/man/man3/pbs_orderjob.3B         | root  | -rw-r--r-- | 2526         |
| PBS_EXEC/share/man/man3/pbs_rerunjob.3B         | root  | -rw-r--r-- | 2531         |
| PBS_EXEC/share/man/man3/pbs_rlsjob.3B           | root  | -rw-r--r-- | 3043         |
| PBS_EXEC/share/man/man3/pbs_runjob.3B           | root  | -rw-r--r-- | 3484         |
| PBS_EXEC/share/man/man3/pbs_selectjob.3B        | root  | -rw-r--r-- | 7717         |
| PBS_EXEC/share/man/man3/pbs_sigjob.3B           | root  | -rw-r--r-- | 3108         |
| PBS_EXEC/share/man/man3/pbs_statjob.3B          | root  | -rw-r--r-- | 4618         |
| PBS_EXEC/share/man/man3/pbs_statnode.3B         | root  | -rw-r--r-- | 3925         |
| PBS_EXEC/share/man/man3/pbs_statque.3B          | root  | -rw-r--r-- | 4009         |
| PBS_EXEC/share/man/man3/pbs_statserver.3B       | root  | -rw-r--r-- | 3674         |
| PBS_EXEC/share/man/man3/pbs_submit.3B           | root  | -rw-r--r-- | 6320         |
| PBS_EXEC/share/man/man3/pbs_submitresv.3B       | root  | -rw-r--r-- | 3878         |
| PBS_EXEC/share/man/man3/pbs_terminate.3B        | root  | -rw-r--r-- | 3322         |
| PBS_EXEC/share/man/man3/tm.3B                   | root  | -rw-r--r-- | 11062        |
| PBS_EXEC/share/man/man7                         | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/share/man/man7/pbs_job_attributes.7B   | root  | -rw-r--r-- | 15920        |
| PBS_EXEC/share/man/man7/pbs_node_attributes.7B  | root  | -rw-r--r-- | 7973         |
| PBS_EXEC/share/man/man7/pbs_queue_attributes.7B | root  | -rw-r--r-- | 11062        |
| PBS_EXEC/share/man/man7/pbs_resources.7B        | root  | -rw-r--r-- | 22124        |

Table 17-1: File Listing

| Directory / File                                 | Owner | Permission | Average Size |
|--|-------|------------|--------------|
| PBS_EXEC/share/man/man7/pbs_resv_attributes.7B   | root  | -rw-r--r-- | 11662        |
| PBS_EXEC/share/man/man7/pbs_server_attributes.7B | root  | -rw-r--r-- | 14327        |
| PBS_EXEC/share/man/man8                          | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/share/man/man8/mpiexec.8B               | root  | -rw-r--r-- | 4701         |
| PBS_EXEC/share/man/man8/pbs-report.8B            | root  | -rw-r--r-- | 19221        |
| PBS_EXEC/share/man/man8/pbsfs.8B                 | root  | -rw-r--r-- | 3703         |
| PBS_EXEC/share/man/man8/pbsnodes.8B              | root  | -rw-r--r-- | 3441         |
| PBS_EXEC/share/man/man8/pbsrun.8B                | root  | -rw-r--r-- | 20937        |
| PBS_EXEC/share/man/man8/pbsrun_unwrap.8B         | root  | -rw-r--r-- | 2554         |
| PBS_EXEC/share/man/man8/pbsrun_wrap.8B           | root  | -rw-r--r-- | 3855         |
| PBS_EXEC/share/man/man8/pbs_attach.8B            | root  | -rw-r--r-- | 3790         |
| PBS_EXEC/share/man/man8/pbs_hostn.8B             | root  | -rw-r--r-- | 2781         |
| PBS_EXEC/share/man/man8/pbs_idled.8B             | root  | -rw-r--r-- | 2628         |
| PBS_EXEC/share/man/man8/pbs_mom.8B               | root  | -rw-r--r-- | 23496        |
| PBS_EXEC/share/man/man8/pbs_mpihp.8B             | root  | -rw-r--r-- | 4120         |
| PBS_EXEC/share/man/man8/pbs_mpirun.8B            | root  | -rw-r--r-- | 3130         |
| PBS_EXEC/share/man/man8/pbs_probe.8B             | root  | -rw-r--r-- | 3344         |
| PBS_EXEC/share/man/man8/pbs_sched_cc.8B          | root  | -rw-r--r-- | 6731         |
| PBS_EXEC/share/man/man8/pbs_server.8B            | root  | -rw-r--r-- | 7914         |
| PBS_EXEC/share/man/man8/pbs_tclsh.8B             | root  | -rw-r--r-- | 2475         |
| PBS_EXEC/share/man/man8/pbs_tmrsh.8B             | root  | -rw-r--r-- | 3556         |
| PBS_EXEC/share/man/man8/pbs_wish.8B              | root  | -rw-r--r-- | 2123         |
| PBS_EXEC/share/man/man8/printjob.8B              | root  | -rw-r--r-- | 2823         |
| PBS_EXEC/share/man/man8/qdisable.8B              | root  | -rw-r--r-- | 3104         |
| PBS_EXEC/share/man/man8/qenable.8B               | root  | -rw-r--r-- | 2937         |
| PBS_EXEC/share/man/man8/qmgr.8B                  | root  | -rw-r--r-- | 7282         |
| PBS_EXEC/share/man/man8/qrun.8B                  | root  | -rw-r--r-- | 2850         |
| PBS_EXEC/share/man/man8/qstart.8B                | root  | -rw-r--r-- | 2966         |
| PBS_EXEC/share/man/man8/qstop.8B                 | root  | -rw-r--r-- | 2963         |
| PBS_EXEC/share/man/man8/qterm.8B                 | root  | -rw-r--r-- | 4839         |
| PBS_EXEC/share/man/man8/tracejob.8B              | root  | -rw-r--r-- | 4664         |
| PBS_EXEC/pgsql                                   | root  | -rwxr-xr-x |              |

Table 17-1: File Listing

| Directory / File                   | Owner | Permission | Average Size |
|------------------------------------|-------|------------|--------------|
| PBS_EXEC/sbin                      | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/sbin/pbs-report           | root  | -rwxr-xr-x | 68296        |
| PBS_EXEC/sbin/pbsfs                | root  | -rwxr-xr-x | 663707       |
| PBS_EXEC/sbin/pbs_demux            | root  | -rwxr-xr-x | 38688        |
| PBS_EXEC/sbin/pbs_idled            | root  | -rwxr-xr-x | 99373        |
| PBS_EXEC/sbin/pbs_iff              | root  | -rwsr-xr-x | 133142       |
| PBS_EXEC/sbin/pbs_mom              | root  | -rwx-----  | 839326       |
| PBS_EXEC/sbin/pbs_probe            | root  | -rwsr-xr-x | 83108        |
| PBS_EXEC/sbin/pbs_rcp              | root  | -rwsr-xr-x | 75274        |
| PBS_EXEC/sbin/pbs_sched            | root  | -rwx-----  | 705478       |
| PBS_EXEC/sbin/pbs_server           | root  | -rwx-----  | 1133650      |
| PBS_EXEC/tcltk                     | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/bin                 | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/bin/tclsh8.3        | root  | -rw-r--r-- | 552763       |
| PBS_EXEC/tcltk/bin/wish8.3         | root  | -rw-r--r-- | 1262257      |
| PBS_EXEC/tcltk/include             | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/include/tcl.h       | root  | -rw-r--r-- | 57222        |
| PBS_EXEC/tcltk/include/tclDecls.h  | root  | -rw-r--r-- | 123947       |
| PBS_EXEC/tcltk/include/tk.h        | root  | -rw-r--r-- | 47420        |
| PBS_EXEC/tcltk/include/tkDecls.h   | root  | -rw-r--r-- | 80181        |
| PBS_EXEC/tcltk/lib                 | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/lib/libtcl8.3.a     | root  | -rw-r--r-- | 777558       |
| PBS_EXEC/tcltk/lib/libtclstub8.3.a | root  | -rw-r--r-- | 1832         |
| PBS_EXEC/tcltk/lib/libtk8.3.a      | root  | -rw-r--r-- | 1021024      |
| PBS_EXEC/tcltk/lib/libtkstub8.3.a  | root  | -rw-r--r-- | 3302         |
| PBS_EXEC/tcltk/lib/tcl8.3          | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/lib/tclConfig.sh    | root  | -rw-r--r-- | 7076         |
| PBS_EXEC/tcltk/lib/tk8.3           | root  | drwxr-xr-x | 4096         |
| PBS_EXEC/tcltk/lib/tkConfig.sh     | root  | -rw-r--r-- | 3822         |
| PBS_EXEC/tcltk/license.terms       | root  | -rw-r--r-- | 2233         |
| PBS_HOME                           | root  | drwxr-xr-x | 4096         |
| PBS_HOME/aux                       | root  | drwxr-xr-x | 4096         |



Table 17-1: File Listing

| Directory / File                      | Owner                | Permission | Average Size |
|---------------------------------------|----------------------|------------|--------------|
| PBS_HOME/checkpoint                   | root                 | drwx-----  | 4096         |
| PBS_HOME/datastore                    | data service account | -rwx-----  |              |
| PBS_HOME/mom_logs                     | root                 | drwxr-xr-x | 4096         |
| PBS_HOME/mom_priv                     | root                 | drwxr-x--x | 4096         |
| PBS_HOME/mom_priv/config              | root                 | -rw-r--r-- | 18           |
| PBS_HOME/mom_priv/jobs                | root                 | drwxr-x--x | 4096         |
| PBS_HOME/mom_priv/mom.lock            | root                 | -rw-r--r-- | 4            |
| PBS_HOME/pbs_environment              | root                 | -rw-r--r-- | 0            |
| PBS_HOME/sched_log                    | root                 | drwxr-xr-x | 4096         |
| PBS_HOME/sched_priv                   | root                 | drwxr-x--- | 4096         |
| PBS_HOME/sched_priv/dedicated_time    | root                 | -rw-r--r-- | 557          |
| PBS_HOME/sched_priv/holidays          | root                 | -rw-r--r-- | 1228         |
| PBS_HOME/sched_priv/resource_group    | root                 | -rw-r--r-- | 0            |
| PBS_HOME/sched_priv/sched.lock        | root                 | -rw-r--r-- | 4            |
| PBS_HOME/sched_priv/sched_config      | root                 | -rw-r--r-- | 6370         |
| PBS_HOME/sched_priv/sched_out         | root                 | -rw-r--r-- | 0            |
| PBS_HOME/server_logs                  | root                 | drwxr-xr-x | 4096         |
| PBS_HOME/server_priv                  | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/accounting       | root                 | drwxr-xr-x | 4096         |
| PBS_HOME/server_priv/acl_groups       | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/acl_hosts        | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/acl_svr          | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/acl_svr/managers | root                 | -rw-----   | 13           |
| PBS_HOME/server_priv/acl_users        | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/config           |                      |            |              |
| PBS_HOME/server_priv/db_user          |                      |            |              |
| PBS_HOME/server_priv/db_password      |                      |            |              |
| PBS_HOME/server_priv/hooks            |                      |            |              |
| PBS_HOME/server_priv/jobs             | root                 | drwxr-x--- | 4096         |
| PBS_HOME/server_priv/license_file     | root                 | -rw-r--r-- | 34           |
| PBS_HOME/server_priv/nodes            |                      |            |              |

Table 17-1: File Listing

| Directory / File                     | Owner | Permission | Average Size |
|--------------------------------------|-------|------------|--------------|
| PBS_HOME/server_priv/queues/newqueue | root  | -rw-----   | 303          |
| PBS_HOME/server_priv/queues/workq    | root  | -rw-----   | 303          |
| PBS_HOME/server_priv/resourcedef     | root  |            |              |
| PBS_HOME/server_priv/server.lock     | root  | -rw-----   | 4            |
| PBS_HOME/server_priv/svrlive         | root  | -rw-----   |              |
| PBS_HOME/server_priv/tracking        | root  | -rw-----   | 0            |
| PBS_HOME/spool                       | root  | drwxrwxrwt | 4096         |
| PBS_HOME/undelivered                 | root  | drwxrwxrwt | 4096         |

# Introduction to PBS

## 18.1 Acknowledgements

PBS Professional is the enhanced commercial version of the PBS software originally developed for NASA. The NASA version had a number of corporate and individual contributors over the years, for which the PBS developers and PBS community is most grateful. Below we provide formal legal acknowledgements to corporate and government entities, then special thanks to individuals.

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