

PBS Professional® 18.2.1

Release Notes



PBS Works is a division of  Altair

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Supported Platforms

1.1 Supported Platforms

For the following platforms, you can download all PBS components:

Table 1-1: Supported Platforms

Maker	Version	Chipset	Notes
Red Hat Enterprise Linux RHEL	6 and 7	x86_64	
	7	ARM64	
CentOS	6.x and 7.x	x86_64	
	7	ARM64	
Cray	CLE 5.1, 5.2, 6.0		
SuSE SLES	11 and 12	x86_64	
	12	ARM64	

1.1.1 Using PBS on Windows

For Windows, use PBS 13.1; do not use PBS 18.2.1.

1.1.2 Using PBS on HPE SGI

For HPE SGI, use PBS 14.2.6; do not use PBS 18.2.1.

1.2 Containers

To run jobs in containers, PBS requires `systemd` enabled and a minimum Docker version of Community Edition 17.03.0 or equivalent.

1.3 Hooks

1.3.1 Python Version

PBS 13.0 uses Python 2.7.1. Please note that use of Python 2.5.1 is **deprecated**.

1.4 MPI

PBS runs jobs with all known implementations of MPI. PBS is integrated more tightly with some versions, providing support for resource tracking and job cleanup after a failure. These are listed here:

Table 1-2: Integrated MPIs

MPI	Version	Platform	Notes
MPICH	1.2.5, 1.2.6, and 1.2.7	Linux	wrapper is depre- recated as of 14.2.1
MPICH2	1.0.3, 1.0.5, 1.0.7	Linux	
MPICH-GM	mpich-1.2.6.14b	Linux	wrapper is depre- recated as of 14.2.1
Intel MPI	2.0.022, 3, and 4.0.3	Linux	
HP MPI	2.0.0	Linux	
Platform MPI	8.0	Linux	
HPE SGI MPI (MPT)		Linux on HPE SGI platforms, including over InfiniBand	
MVAPICH	1.2.7	Linux	wrapper is depre- recated as of 14.2.1
MVAPICH2	1.7	Linux	

The following MPIs have taken the steps to integrate tightly with PBS:

Table 1-3: MPIs Self-integrated with PBS

MPI	Version	Platform	
LAM/MPI	6.5.9, 7.0.6, 7.1.1	Linux	
OpenMPI	1.4.2		

1.5 MUNGE

PBS can be configured to use MUNGE version 0.5.11

1.6 CSA

Support for CSA is no longer available on non-Cray machines.

Any system running PBS and Performance Suite will not support CSA.

1.7 Altair License Server

For a list of supported platforms for the Altair License Server, see the License Server release notes. These are available from the PBS Works Documentation Download Area:

<https://secure.altair.com/UserArea/docs.php>

1.8 Platform Deprecations

Table 1-4: Platform Deprecations

PBS Version	Change
14.2.1	Support for wrapper for MPICH is deprecated
14.2.1	Support for wrapper for MVAPICH is deprecated
13.1	Support for AIX is deprecated
13.1	Support for CentOS 5 is deprecated
13.1	Support for RHEL5 is deprecated
13.1	Support for SuSE SLES10 is deprecated
13.1	Support for Windows Server 2003 is deprecated
13.0	Using <code>pbsrun_wrap</code> and <code>pbsrun_unwrap</code> for Intel MPI is deprecated
12.2	Support for HPCBP jobs is removed
12.0	Support for LAM MPI 6.5.9 is deprecated
12.0	Use of Python 2.5 is deprecated, to be replaced by 2.7 in a future release.
11.3	Globus can still send jobs to PBS, but PBS no longer supports sending jobs to Globus
	Support in PBS for CSA on HPE SGI systems is removed .

2

Special Notes

2.1 Upgrading

2.1.1 Choosing Between Overlay and Migration Upgrades

We recommend a migration upgrade for the following:

- On Cray: when upgrading from pre-11.0 to 11.0 or newer
- If you are running a PBS version older than 5.3
- When moving between 32-bit and 64-bit versions of PBS
- When certain European or Japanese characters are stored in the datastore on versions of PBS older than 12.0

We recommend an overlay upgrade for the following:

- On Cray: when upgrading from 11.0 and newer
- Other Linux/UNIX platforms: when upgrading from 5.3 or newer

See the *PBS Professional Installation & Upgrade Guide*.

2.1.2 Order of Upgrades

When upgrading a PBS complex, make sure that all MoMs are upgraded before upgrading the server. Do not start the new server until all MoMs have been upgraded and restarted.

2.1.3 User Performing Upgrade Must be Database Creator

In order to upgrade the database, the user performing the upgrade must be the same user who created the database. If you will use a different database user after the upgrade, make that change after the upgrade. Perform the upgrade as the user who created the database, then change the user to the new desired user. Follow these steps:

1. Run this command on the PBS database in order to identify the user who originally created the database (this is one line):

```
su - <data_user> -s /bin/sh -c "LD_LIBRARY_PATH=$PBS_EXEC/pgsql/lib $PBS_EXEC/pgsql/bin/psql -U  
<data_user> -p <data_port> -d pbs_datastore"
```

data_port defaults to "15007"

data_user defaults to "pbsdata"

2. Run this query to get the list of users in the database:

```
pbs_datastore=# select pg_authid.oid, rolname from pg_authid;  
oid | rolname  
-----+-----  
10 | pbsdata  
16541 | ash
```

(2 rows)

- Find the original user who created the database (this is one line):

```
pbs_datastore=# select pg_authid.oid, rolname from pg_authid where pg_authid.oid=10;
```

```
oid | rolname
-----+-----
  10 | pbsdata
```

(1 row)

- Exit from the PBS database
- If the user does not exist, create the user in the system
- Update the current database user to the original user who created the database:

```
pbs_ds_password -C pbsdata
```

- Perform an overlay upgrade
- Reset the current database user to the desired username:

```
pbs_ds_password -C "username"
```

2.1.4 Rolling upgrades

Rolling upgrades are not supported. However, you can perform a rolling upgrade from 14.2 or later to a newer release (you cannot go from pre-13.0 to post-13.0), and in the second paragraph, we provide some information about how to do a rolling upgrade. You should upgrade all MoMs and the server/scheduler at the same time; an older MoM cannot interoperate with a newer server. For example, an 18.2.1 server will report all pre-13.0 MoMs as down.

Before performing a rolling upgrade, consider stopping the scheduler before beginning the upgrade. When MoMs are upgraded to 18.2.1, they become unable to communicate with the server and vice versa. The scheduler cannot see or use the vnodes, and the MoMs cannot send obits to the server. After the server is upgraded, communication is restored, the scheduler can send jobs, and MoMs can send obits to the server. However, if the scheduler is running during a rolling upgrade, two things may happen:

- Jobs that were top jobs may lose their top job status, and therefore any resources the scheduler has designated for them may be assigned to other jobs. This can delay top jobs.
- As vnodes become unavailable to the scheduler, users may become concerned because their jobs may stay queued with a comment saying that their job can never run. Once all vnodes and the server are upgraded, the jobs can run.

2.1.5 Upgrading Caveats

- Warning when upgrading from 14.2.1: avoid using “`rpm -U`”. Instead, uninstall 14.2.1 using “`rpm -e`”, then install the next version using “`rpm -i`”.
- The `qrerun` command does not requeue job arrays. Instead, it leaves them in the *B* (begun) state. During a migration upgrade, you can work around this problem by using the `qhold` command on the job array, then using `qmove` to move it to the new server, then using the `qrls` command.

2.1.6 PBS Requires Altair License Server

PBS 11.0 and newer uses the Altair License Server. If you are not using socket licenses for all machines, you should install and configure the Altair License Server before you upgrade PBS. See the *PBS Professional Installation & Upgrade Guide* and the *Altair License Manager Installation and Operations Guide*.

2.2 Licensing

- As of 11.3, PBS can license jobs using socket licenses and/or floating licenses. Floating licenses are managed via the Altair License Server. You CANNOT use a FLEX server with PBS 18.2. Follow the instructions in the *Altair License Manager Installation and Operations Guide*.
- The Licensing chapter in the *PBS Professional Installation & Upgrade Guide* describes how to configure PBS Professional to use the Altair License Server and/or socket licenses.
- If you find that the PBS server host becomes unresponsive a short time after startup, the server may be trying to contact the wrong license server. See the Troubleshooting chapter in the *PBS Professional Administrator's Guide*.
- The `pbs_license_file_location` server attribute is deprecated. The installation script unsets this attribute during an upgrade. This is intentional. Use instead the `pbs_license_info` server attribute.
- The minimum number of PBS Works licenses that can be checked out is one (1). If the `pbs_license_min` server attribute is set to zero or unset, PBS automatically sets the number to one.
- As of version 13.1, the default value for the `pbs_license_linger_time` server attribute is set to 1 year (31536000 seconds). The previous default value was 3600 seconds. This means that any unused licenses are checked back in to the license server after a year, instead of one hour. This value can be overridden by setting the value of `pbs_license_linger_time` via `qmgr`.
- If you are using socket-based licenses to run PBS Professional, you will be asked for the host ID when generating the license file. You will need to run the `almutil` utility to gather this information. You can get the `almutil` utility from either:
 - An existing LM-X Altair License Server installation
 - A tar file containing `almutil` binaries available on the Altair Registered User License Manager page after selecting "Create New License". Extract the version you need for your PBS server platform.

You can refer to the *Altair License Manager Installation and Operations Guide* (also available from the Registered User Area site) if you are unsure which binary you should use for your particular platform.

- If `/tmp` is mounted `noexec`, this may prevent PBS from checking out licenses.

2.3 Installation

- Any `PBS_START_*` parameters set in the environment are not picked up and set in `pbs.conf`. You must specify these in `pbs.conf`; do not export them.
- Create data service account:

Under UNIX/Linux, we recommend that the PBS administrator creates a new data service account called "pbsdata" before installing PBS. This account must be created correctly, otherwise the database can crash. See the *PBS Professional Installation & Upgrade Guide* for details.

2.3.1 Caveats for Uninstalling on Linux

Using `rpm -e`, even on an older package than the one you are currently using, will cause any currently running PBS daemons to shut down, and will also remove the system V init and/or systemd service startup files. If you wish to remove an older rpm without these effects, use `rpm -e --noscripts`.

2.4 General

- If you set `PBS_LEAF_NAME` on a primary or secondary server host, make sure that `PBS_PRIMARY` and `PBS_SECONDARY` match `PBS_LEAF_NAME` on the corresponding host. If you do not set `PBS_LEAF_NAME` on a server host, make sure that `PBS_PRIMARY` and `PBS_SECONDARY` match the hostnames of the server hosts.
- If you will use GPUs or Xeon Phi with cgroups and you use `pbs_attach` to spawn processes, do not use the standard `pbs_attach`; get a modified version of `pbs_attach` from Altair.
- If you are using `PBS_COMM_ROUTERS` as a comma-separated list, add port information to each entry. Port information has this format: `<port>` and the default port number is `17001`. For example:
`PBS_COMM_ROUTERS=x58-r7:17001,x18-64:17001`
- Do not put a CPU time limit on the `pbsdata` user. The datastore will die, and kill the server.
- PBS-20383: If `$restrict_user` is enabled but `$restrict_user_maxsysid` is not set, `$restrict_user` tries to read the values of `SYSTEM_UID_MAX` from `/etc/login.defs` in the `pbs_init.d` script. Unfortunately on newer OSes `/etc/login.defs` uses `SYS_UID_MAX/MIN` (note old "SYSTEM_" vs. new "SYS_"). Because of the change, the `check_maxsysid()` function in `pbs_init.d` fails and defaults to a value of `UID_MIN - 1`. For example if a `login.defs` file had `UID_MIN 10000` then `$restrict_user_maxsysid` ends up using the value 9999.

The workaround is to edit the `/etc/init.d/pbs` and `$PBS_EXEC/libexec/pbs_init.d` scripts on newer OSes (e.g. SLES12) to include the old definitions (`SYSTEM_UID...`)

- PBS-12708 (SPID 300546): sorting vnodes by "ncpus HIGH unused"

When sorting vnodes by "ncpus HIGH unused", vnodes are actually sorted first according to the free CPUs on the host, rather than on the vnode. So where HostA has 3 free CPUs on one vnode, and HostB has two vnodes, each with 2 free CPUs, this sort places a job on HostB instead of HostA.

- The `pbs.server.scheduler_restart_cycle()` function stops the current scheduler cycle, rather than restarting it. This behavior will change in a later release. When a hook's `fail_action` attribute is set to `scheduler_restart_cycle`, it uses the function, so the name of the action doesn't match the action.
- Do not perform partial removal of custom resources. It is important to remove custom resources correctly. See the instructions in the Resources chapter of the *PBS Professional Administrator's Guide*.
- Do not use different versions of PBS within the same complex. All machines using the same PBS server should run the same version of PBS. Do not mix major or minor versions. For example, do not run 14.2 and 18.2 in the same complex.
- Do not use `qmgr` to set or change the vnode sharing attribute, or a vnode's `ncpus`, `vmem` or `mem`. Instead, create a new vnode definition file and use `"pbs_mom -s insert"` to add the file. Then HUP the MoM. There are requirements for the vnode definition file. See the *PBS Professional Administrator's Guide*, "How to Configure MoMs and Vnodes".
- All printable characters are allowed in a resource value, except for comma, space, colon, quotes, and ampersand, but are subject to some restrictions such as those imposed by `select` and `place`. Also, if these resource values are used as pathnames, they are subject to the restrictions of the operating system.
- In the server `periodic` hook that runs `pbs_est`, the `alarm` attribute has no effect. If the `alarm` timeout is reached, the hook terminates, but `pbs_est` continues to run.
- The `qrerun` command does not requeue job arrays. Instead, it leaves them in the *B* (begun) state.
- Enabling X11 forwarding:

In order to enable X11 forwarding, add the path to the `xauth` binary to each MoM's `pbs_environment` file. For example:

```
echo $PATH
```

```
/bin:/user/bin
```

```
-bash-3.2$ which xauth
```

```
/usr/bin/X11/xauth
```

The entry in the `pbs_environment` file should be the following:

```
PATH=/bin:/usr/bin:/usr/bin/X11
```

- PBS-4559 (SPID 247762): `RLIMIT MEMLOCK` unlimited at startup (11.3 and newer)

On systems that are capable of setting a limit for locked memory (RLIMIT_MEMLOCK), MoM sets this to unlimited at startup. This is inherited by jobs.

- Make sure that all machines use the same Locale setting. If you try to modify the **Account** or **Project** attributes of an existing job using the `qalter` command or the `pbs_alterjob()` API so that the attribute will contain a non-ASCII, non-UTF-8 character, the PBS server and database may shut down. This happens when some machines are on a different Locale setting from others.
- If the `node_fail_requeue` server attribute is unset, it behaves as if it is set to zero, until the server is restarted. After the server is restarted, it reverts to its default value of 310.
- The functionality of `qdel -w force` has changed, and may cause unexpected behavior on some systems. See the `qdel` command in the *PBS Professional Reference Guide*.
- As of 13.0, PBS uses TCP instead of UDP for communication. See the Communication chapter in the *Installation & Upgrading Guide*.
- In the past, some PBS components defaulted to `/tmp` for storing temporary files. All components now default to `/var/tmp` which is most likely a persistent storage location. Administrators should take this into account and adjust the cleaning of `/var/tmp` accordingly.
- The exit value of an interactive job is always logged as zero in the accounting record, regardless of actual exit code value.
- When creating a MoM version 2 configuration file that will change natural vnode attributes, always explicitly specify `resources_available.ncpus`. Otherwise, vnodes accept only one job regardless of available CPUs.
- Warnings about using `pbsnodes` command:
 - a. You must define the `nmics`, `ngpus`, and `OS` resources in order to have their values displayed in the summary output.
 - b. While there is a header in the Job Summary output for suspended jobs on the vnode, this functionality is not yet implemented, and the value displayed is always zero.
- If you install a MoM but initially set `PBS_START_MOM=0` in `pbs.conf`, and start PBS, the MoM directories are not created. If you subsequently decide to run a MoM on this vnode, you must run `/opt/pbs/default/etc/pbs_habitat` in order to create the MoM directories.
- PBS-13383 (SPID 334661): If the `holidays` file is incomplete, `pbs_sched` hangs when `strict_ordering` and `backfill` are enabled.
- When using non-standard characters in file staging paths, make sure that your paths work with your shell and `scp` or `rcp`.

2.5 Hooks

- (13.0) PBS includes three new hook events and several other changes to the PBS Plugins infrastructure. See the *PBS Professional Plugins (“Hooks”) Guide*.
- Before creating any execution event hooks, read the *PBS Professional Plugins (“Hooks”) Guide*.
- (12.0) PBS allows hooks that run once a job is at the execution host, and hooks that periodically run on all execution hosts.
- Administrators who are writing provisioning hooks need to be aware that the Python `pbs.event().reject()` function fails to log the error message when used from a provisioning hook. This function behaves correctly for all other hooks supported by PBS Professional.
- Do not use the `pwd` module included with Python 2.5.1. This can cause a server crash.
- Support for Python 2.5 is deprecated as of PBS 12.0. PBS will use a later version of Python in later releases of PBS.
- If a job tries to run where the complete update has not taken place, a hook could attempt to use resources that are not yet available, causing an unhandled exception. Make sure that your execution event hooks do not delete jobs if this should happen. Write your hooks so that they trap unhandled exceptions and deal gracefully with the job. For example, you can use `pbs.event().job.rerun()`.
- As PBS copies or deletes execution or periodic hooks to the MoMs, the following messages are printed in the server's log file at 2047:


```
"successfully sent hook file <filename> to <mom_hostname>"
"successfully sent rescdef file <filename> to <mom host name>"
"successfully deleted hook file <filename> from <mom host name>"
"successfully deleted rescdef file <filename> from <mom host name>"
"failed to copy hook file <filename> to <mom host name>"
"failed to copy rescdef file <filename> to <mom host name>"
"failed to delete hook file <filename> from <mom host name>"
"failed to delete rescdef file <filename> from <mom host name>"
```
- The following are hook-related error codes:

Table 2-1: Hook-related Error Codes

Error Name	Code	Description
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

- You may find that when you remove a hook, it takes some time for the hook to be completely purged. If you run `qmgr -c 'create hook <hook_name>'` where a previous hook of the same `<hook_name>` still exists, you will see the following message:


```
"hook name <hook_name> is pending delete, try another name"
```

 Either specify another name for the hook, or retry the `qmgr` request again later, after the previous hook is completely purged.

2.6 Cray

2.6.1 Patch Requirement for Cray

You must patch BASIL in order for PBS Professional to run on CLE 5.2. As per Cray FN #6020 "BASIL inventory change breaks WLM code", apply patch PS63 to CLE 5.2 UP02 and prior 5.2 releases before updating PBS to 12.2.402 or later.

2.6.2 Composition of PBS Complex on Cray

PBS can manage non-Cray Linux vnodes along with Cray systems in the same PBS complex. A single PBS complex can consist of the following:

- The PBS server and scheduler on one of the following:
 - Cray login nodes
 - esLogin nodes
 - Repurposed compute nodes
 - The sdb node
- MoMs on all of the following, simultaneously:
 - Cray login nodes
 - Cray esLogin nodes
 - Repurposed Cray compute nodes, running operating systems supported by PBS

2.6.3 Installing and Upgrading

Installing and upgrading on the Cray has changed. Please see “Installing and Upgrading on Cray” in the *PBS Professional Installation & Upgrade Guide*.

2.6.4 Provisioning

The Xeon Phi provisioning hook is not installed by default. If required, it can be installed by copying the following files from `$PBS_EXEC/lib/python/altair/pbs_hooks` to `$PBS_HOME/server_priv/hooks`:

```
PBS_xeon_phi_provision.HK
PBS_xeon_phi_provision.PY
```

2.6.5 Change in Behavior

The default number of vnodes per NUMA node has changed. Prior to 18.x, PBS created one vnode per NUMA node, but from 18.x forward, PBS creates one vnode per compute node.

2.6.6 Limitations

The following features are not supported or not available on Cray:

- Bursting jobs to the cloud
- Running jobs in containers
- OS provisioning
- Power awareness is not supported on ARM64
- The `execjob_prologue` hook: the `execjob_prologue` hook runs only on login nodes, not on compute nodes
- The `cgroups` hook: the `cgroups` hook runs only on login nodes, not on compute nodes
- Kerberos is not supported on the Cray.
- The `pbs_release_nodes` command and the `release_nodes_on_stageout` job attribute are not supported on Cray.

2.6.7 Do Not Use mpp* Resources

The `select/place` language used by all other platforms was introduced to Cray platforms with PBS Pro v11.0 in 2010. To ease the transition to this new way of submitting jobs, the `mpp*` resources then in use on Cray were automatically translated by PBS via a `PBS_translate_mpp` hook into the `select/place` language. At the same time use of the `mpp*` resources was deprecated, which meant that support could be dropped in some future release. As of PBS Pro v18.2 the `PBS_translate_mpp` hook is being disabled and **support for mpp* is ended**. The behavior when requesting them for a job is undefined.

2.7 MPI

- The default for starting wrapped mpids is `rsh`. If you are wrapping HP MPI with the PBS `pbs_mpihp`, and you want to use something other than `rsh`, be sure to set `PBS_RSHCOMMAND` in `PBS_HOME/pbs_environment`. For example:

```
PBS_RSHCOMMAND=ssh
```

- MPD rings:

As has been observed with `mpich2-1.0.3`, when starting MPD daemons, only one MPD per user on an execution host can be run; multiple MPD rings can be created per user as long as each participating execution host is in only one ring. Otherwise, jobs with intersecting execution hosts on their MPD rings can interfere with one another.

Suggested workarounds:

Given that only 1 MPD per user on an execution host can be run, do one of the following:

1. Set 1 job per user to run on a PBS node by setting:


```
# qmgr -c "set node <node_name> max_user_run=1"
```
2. Force users to submit jobs to run on nodes exclusively using the `excl` keyword in `-l place` as in:

```
% qsub -l select=2:ncpus=1:mpiprocs=2 -l place=free:excl job.scr
```

In addition, to set this default job-wide resource on the server, the admin can set:

```
# qmgr -c "set server resources_default.place=free:excl"
```

Note: Workaround 2 prevents other users from using the same node if it has more than 1 `resources_available.ncpus`.

- If you will use suspend/resume with Platform MPI, make sure that `MPI_BUNDLE_MPIDS` is not set.

2.8 Libraries

2.8.1 Dependency on libdl

If you are integrating for example OpenMPI with the PBS tm API by using the `--with-tm` option, you need to use `libdl`. Before you configure and make OpenMPI, you can do this:

```
export LIBS=-ldl
```

As of 13.1, `libpbs.a` uses `dlopen`, `dldclose`, `dlsym` etc. for MUNGE-related APIs etc.

2.8.2 Requirement for ALSDK

If you need to have `noexec` on your `/tmp`, do one of the following:

- Set the `TMPDIR` environment variable; the shared library that is extracted to `/tmp/xf-dll` follows `TMPDIR` if it is set
- Install a soft link from `/tmp/xf-dll` pointing to a location on a filesystem that does not have the "noexec" mount flag

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

2.8.3 Dependencies on Linux Shared Object Libraries

Altair distributes separate PBS packages for different supported Linux distributions. Customers running on SLES and RHEL distributions should take care to use the correct package for their systems. For example, in a complex made up of RHEL 6 and RHEL 7 hosts, the RHEL6 package should be used on the RHEL 6 hosts, and the RHEL7 packages should be used on the RHEL 7 hosts.

If PBS Professional is deployed onto Linux distributions other than the supported SLES and RHEL distributions, there may be runtime problems with dependencies on shared object libraries, typically `libssl.so` or `libcrypto.so`.

Customers who encounter such problems should first determine which supported distribution is most similar to that installed on their systems. For example, `openSUSE 10.x` is similar to SLES 10, and CentOS distributions are similar to RHEL. The customer should then try the PBS package that is supported for the similar system.

If the runtime dependencies are still not resolved, there are two other approaches that may be tried. Before trying either approach, first run `ldd` on `pbs_mom` to get name and version number of libraries that PBS requires. `pbs_mom` needs to be extracted from the PBS rpm by using the Linux `rpm2cpio` and `cpio` commands.

Here is an example using an installed SLES 10 x86_64 `pbs_mom`:

```
shell> ldd /opt/pbs/default/sbin/pbs_mom
libdl.so.2 => /lib64/libdl.so.2 (0x00002b23b0a59000)
libcrypt.so.1 => /lib64/libcrypt.so.1 (0x00002b23b0b5d000)
libssl.so.0.9.8 => /usr/lib64/libssl.so.0.9.8 (0x00002b23b0c96000)
libc.so.6 => /lib64/libc.so.6 (0x00002b23b0ddd000)
libcrypto.so.0.9.8 => /usr/lib64/libcrypto.so.0.9.8 (0x00002b23b100d000)
/lib64/ld-linux-x86-64.so.2 (0x00002b23b093c000)
```

The Linux incompatibilities are generally associated with `libcrypto.so`, which is required by `libssl.so`.

Having identified the requisite version of `libcrypto.so` and `libssl.so`, there are two options:

1. Locate and install an OpenSSL compatibility library that will satisfy the dependency. In the example above, the library needs to satisfy the dependency on `libcrypto.so.0.9.8`.
2. Download and install a version of OpenSSL that corresponds to the dependency determined above (e.g., `libcrypto.so.0.9.8`).

New Features and Interface Changes

3.1 New Features

See New Features in the *PBS Professional Administrator's Guide*.

3.2 External Interface Changes

These are the external interface changes introduced in version 12.0 and newer.

3.2.1 Changes in Paths, Parameters, and Environment Variables

Table 3-1: Changes in Parameters and Environment Variables

PBS Version	Change
18.2.1	On Windows, default path for PBS_HOME and PBS_EXEC changed to C:\Program Files (x86)\PBS\home and C:\Program Files (x86)\PBS\exec
14.2.1	New pbs.conf parameter PBS_MOM_NODE_NAME
13.0	The TMPDIR environment variable is deprecated and replaced with PBS_TMPDIR
13.0	The PBS_COMM_LOGMASK parameter is changed to PBS_COMM_LOG_EVENTS
12.1	In pbs.conf, PBS_CORE_LIMIT is set to <i>unlimited</i> by default

3.2.2 Changes in Error Messages Etc.

Table 3-2: Changes in Error Messages, Etc.

PBS Version	Change
13.0	Job and reservation names can be 236 characters
13.0	Fairshare and job sort formulas use Python math functions
12.0	Error message change: "Resources request is impossible to solve, job will never run" is replaced by "Error in calculation of start time of top job"

3.2.3 Changes to Server

Table 3-3: Changes to Server

PBS Version	Change Type	Change
18.2.1	New attribute	New <code>acl_host_moms_enable</code> server attribute
18.2.1	New attribute	New <code>restrict_res_to_release_on_suspend</code> server attribute
14.2.1	New attribute	New <code>python_restart_max_hooks</code> server attribute
14.2.1	New attribute	New <code>python_restart_max_objects</code> server attribute
14.2.1	New attribute	New <code>python_restart_min_interval</code> server attribute
14.2.4	Attribute deprecated	The <code>max_group_res</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_group_res_soft</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_group_run</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_group_run_soft</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_running</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_user_res</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_user_res_soft</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_user_run</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_user_run_soft</code> server attribute is deprecated.
14.2.4	Attribute deprecated	The <code>max_queueable</code> server attribute is deprecated.
13.1	New attribute	New <code>jobscript_max_size</code> server attribute
13.0	New attribute	New <code>queued_jobs_threshold</code> server attribute
13.0	New attribute	New <code>queued_jobs_threshold_res.<resource></code> server attribute
	Attribute deprecated	The server attribute <code>pbs_license_file_location</code> is deprecated, and replaced by <code>pbs_license_info</code> .

3.2.4 Changes to Scheduler

Table 3-4: Changes to Scheduler

PBS Version	Change Type	Change
18.2.1	New scheduling feature	New multisched feature
18.2.1	New scheduler attribute	New partition scheduler attribute
18.2.1	New scheduler attribute	New scheduling scheduler attribute
18.2.1	New scheduler attribute	New <code>scheduler_iteration</code> scheduler attribute
18.2.1	Deprecation	<code>mom_resources</code> deprecated
18.2.1	Deprecation	Scheduler reads changes from <code>pbsfs</code> without HUP or restart

Table 3-4: Changes to Scheduler

PBS Version	Change Type	Change
18.2.1	Deprecation	The <code>help_starving_jobs</code> scheduler parameter is deprecated. Instead, use <code>eligible_time</code> in the job formula. See also the <code>topjob_ineligible</code> job attribute.
18.2.1	New formula keyword	New <code>fairshare_tree_usage</code> formula keyword
18.2.1	New formula keyword	New <code>fairshare_factor</code> formula keyword
18.2.1	Change in formula keyword	New <code>fairshare_perc</code> formula keyword replaces <code>fair_share_perc</code> ; <code>fair_share_perc</code> is deprecated
14.2.3	Deprecation	The <code>mom_resources</code> line in <code>sched_priv/sched_config</code> is deprecated. Instead, use <code>exechost_periodic</code> hooks. See Example9-15: “Periodically update resources on vnodes” in the <i>PBS Professional Plugins (“Hooks”) Guide</i> .
14.2.1	Server attribute obsolete	The <code>est_start_time_freq</code> server attribute is obsolete
13.1	Scheduler configuration parameter obsoleted	The <code>preempt_priority</code> argument to the <code>job_sort_key</code> scheduler parameter is obsolete (this behavior is the default)
13.1	Scheduler configuration parameter deprecated	The <code>backfill</code> scheduler parameter is deprecated. Use <code>backfill_depth =0</code> instead.
13.1	New scheduler attribute	New <code>opt_backfill_fuzzy</code> scheduler attribute
13.0	Scheduler configuration parameter deprecated	The <code>half_life</code> scheduler parameter is deprecated, replaced with <code>fairshare_decay_time</code> and <code>fairshare_decay_factor</code>
13.0	Scheduler configuration parameter removed	The <code>sort_queues</code> scheduler parameter has no effect.
13.0	New scheduler attribute	New <code>sched_preempt_enforce_resumption</code> scheduler attribute
13.0	Scheduler parameter deprecated	The <code>preempt_priority</code> argument to the <code>job_sort_key</code> scheduler parameter is deprecated
12.2	Scheduler configuration parameter deprecated	The <code>smc_cluster_dist</code> scheduler parameter is deprecated
12.2	Scheduler configuration parameter deprecated	The <code>sort_queues</code> scheduler parameter is deprecated (this behavior is now automatic)
	Scheduler configuration parameter deprecated	The sort_priority option to job_sort_key is deprecated and is replaced with the <code>job_priority</code> option.
	Scheduler configuration option deprecated	The sync_time scheduler configuration option is deprecated.

3.2.5 Resource Changes and Deprecations

Table 3-5: Resource Changes and Deprecations

PBS Version	Change
18.2.1	New <code>soft_walltime</code> resource
18.2.1	The <code>netwins</code> resource is no longer available. PBS no longer schedules jobs using this resource, and does not track or compute this resource.
18.2.1	The <code>mpp*</code> resources are removed.
18.2.1	The <code>PBScrayseg</code> resource is no longer used.
13.0	New <code>preempt_targets</code> resource
11.0	The <code>mpp*</code> resources are deprecated
	The <code>nodes</code> resource is no longer used.
	The resource <code>arch</code> is only used inside of a select statement.
	The resource <code>host</code> is only used inside of a select statement.
	The <code>nodect</code> resource is obsolete. The <code>ncpus</code> resource should be used instead. Sites which currently have default values or limits based on <code>nodect</code> should change them to be based on <code>ncpus</code> .
	The <code>neednodes</code> resource is obsolete.
	The <code>ssinodes</code> resource is obsolete.
	Properties are replaced by boolean resources.

3.2.6 Command Changes and Deprecations

Table 3-6: Command Changes and Deprecations

PBS Version	Change
18.2.1	“ <code>qmgr <command> sched</code> ” without specifying name is deprecated
18.2.1	New <code>-j</code> sub-option to <code>qsub -m</code>
18.2.1	New <code>pbs_topologyinfo -l</code> option
18.2.1	<code>pbsfs -g</code> prints entity effective usage
18.2.1	New <code>qstat -F json</code> option
18.2.1	New <code>qstat -F dsv</code> option
18.2.1	New <code>qstat -fw</code> option
18.2.1	New <code>admin-resume</code> pseudo-signal for <code>qsig</code>
18.2.1	New <code>admin-suspend</code> pseudo-signal for <code>qsig</code>
18.2.1	The <code>pbs-report</code> command is no longer supported , and has been moved to the unsupported directory
14.2.1	The <code>pbs_probe</code> command is deprecated
14.2.1	New <code>qstat -E</code> option

Table 3-6: Command Changes and Deprecations

PBS Version	Change
14.2.1	The <code>pbs_probe</code> command is deprecated
13.1	The <code>qorder</code> command is deprecated
13.0	You can create custom resources with <code>qmgr</code>
13.0	Added <code>qsub -f</code> option
13.0	The <code>xpbs</code> and <code>xpbsmon</code> interfaces to PBS are deprecated
13.0	Using <code>pbsrun_wrap</code> and <code>pbsrun_unwrap</code> for Intel MPI is deprecated
13.0	The <code>xpbs</code> and <code>xpbsmon</code> interfaces to PBS are deprecated
12.2	The <code>qsub -W interactive = true</code> option is deprecated; use <code>qsub -I</code>
12.2	You can edit the <code>qmgr</code> command line
12.1	The <code>pbs-report</code> command is deprecated and moved to the "unsupported" directory
12.1	<code>qmgr</code> command: question mark now equivalent to "help"
12.0	New <code>pbs_interactive</code> command
	The <code>pbs_hostid</code> command is no longer available.
	The <code>-a</code> option to the <code>pbs_sched</code> command is deprecated.
	<code>qsub</code> : the <code>-lnodes=nodespec</code> form is replaced by the <code>-l select=</code> and <code>-l place=</code> statements.
	The <code>-l resource=rescspec</code> form is replaced by the <code>-l select=</code> statement.
	The <code>-a</code> option to the <code>qselect</code> command is deprecated.
	The <code>-wdelay=nnnn</code> option to the <code>qdel</code> command is deprecated.
	The <code>-c</code> and <code>-d</code> options to the <code>pbsnodes</code> command are deprecated and removed.
	The <code>pbs_tclapi pbsrescquery</code> command is deprecated.
	The <code>pbs_rescquery</code> command is deprecated.
	The <code>configrm()</code> resource monitor API call is deprecated.

3.2.7 Vnode Changes

Table 3-7: Vnode Changes

PBS Version	Type	Change
18.2.1	New vnode attribute	New <code>maintenance_jobs</code> attribute
18.2.1	New vnode attribute	New <code>last_state_change_time</code> attribute
18.2.1	New vnode attribute	New <code>last_used_time</code> attribute
18.2.1	New vnode attribute	New <code>power_provisioning</code> attribute
18.2.1	New vnode attribute	New <code>partition</code> attribute
18.2.1	New vnode attribute	New <code>poweroff_eligible</code> attribute

Table 3-7: Vnode Changes

PBS Version	Type	Change
18.2.1	New vnode attribute	New <code>provision_enable</code> attribute
18.2.1	New vnode state	New <code>sleep</code> vnode state
18.2.1	New vnode state	New <code>maintenance</code> state
18.2.1	End of support	The <code>max_group_run</code> vnode attribute is no longer supported.
18.2.1	End of support	The <code>max_running</code> vnode attribute is no longer supported.
18.2.1	End of support	The <code>max_user_run</code> vnode attribute is no longer supported.
14.2.4	Deprecation	The <code>max_group_run</code> vnode attribute is deprecated.
14.2.4	Deprecation	The <code>max_running</code> vnode attribute is deprecated.
14.2.4	Deprecation	The <code>max_user_run</code> vnode attribute is deprecated.
12.2	New vnode attribute	The <code>pcpus</code> vnode attribute is deprecated
11.3	New vnode attribute	New <code>license_info</code> attribute
	Vnode type change	The time-shared node type is no longer used, and the :ts suffix is obsolete.
	Vnode type change	The cluster node type is no longer used.

3.2.8 Queue Changes

Table 3-8: New Queue Attributes

PBS Version	Change
14.2.4	The <code>max_group_res</code> queue attribute is deprecated.
14.2.4	The <code>max_group_res_soft</code> queue attribute is deprecated.
14.2.4	The <code>max_group_run</code> queue attribute is deprecated.
14.2.4	The <code>max_group_run_soft</code> queue attribute is deprecated.
14.2.4	The <code>max_running</code> queue attribute is deprecated.
14.2.4	The <code>max_user_res</code> queue attribute is deprecated.
14.2.4	The <code>max_user_res_soft</code> queue attribute is deprecated.
14.2.4	The <code>max_user_run</code> queue attribute is deprecated.
14.2.4	The <code>max_user_run_soft</code> queue attribute is deprecated.
14.2.4	The <code>max_queueable</code> queue attribute is deprecated.
13.1	<code>backfill_depth</code>
13.0	<code>queued_jobs_threshold</code>
13.0	<code>queued_jobs_threshold_res.RES</code>

3.2.9 New Job Attributes

Table 3-9: New Job Attributes

PBS Version	Change
18.2.1	resources_released
18.2.1	resource_released_list
18.2.1	New soft_walltime attribute
18.2.1	New estimated.soft_walltime
13.1	topjob_ineligible
12.0	min_walltime
12.0	max_walltime

3.2.10 New MoM Configuration Variables

Table 3-10: New MoM Configuration Variables

PBS Version	Type	Change
12.0	New MoM configuration variable	\$reject_root_scripts
	MoM configuration variable deprecation	The memreserved MoM configuration option is deprecated.

3.2.11 Hook Changes

Table 3-11: Hook Changes

PBS Version	Type	Change
18.2.1	Hook removal	pbs_ibwins.py is no longer available.
13.0	New attribute	fail_action
13.0	New attribute	debug
13.0	New event	execjob_launch
13.0	New event	execjob_attach
13.0	New event	exehost_startup

3.2.12 File Changes

Table 3-12: File Changes

PBS Version	Change
18.2.1	New debuginfo RPM files
13.0	The resourcedef file is deprecated (13.0)

3.2.13 Licensing Changes

Table 3-13: Changes to Licensing

PBS Version	Change
18.2.1	Floating licenses are deprecated.
18.2.1	New node licensing
18.2.1	A complex can use at most one kind of licensing: PBS Works node, socket, or (deprecated) floating.
18.2.1	HWU licensing is deprecated.
18.2.1	HWU licenses cannot be mixed with socket or node licenses.
18.2.1	The use of T licenses is deprecated.

3.3 Documentation Changes

Table 3-14: Documentation Changes

PBS Version	Change
18.2.1	New Cray chapter in Install Guide
18.2.1	New Cray chapter in Administrator's Guide
18.2.1	New Cray chapter in User's Guide
18.2.1	New Cloud chapter in Administrator's Guide
18.2.1	New Containers chapter in Administrator's Guide
18.2.1	New Cgroups chapter in Administrator's Guide
18.2.1	New Power Management chapter in Administrator's Guide
18.2.1	Integrations chapter in Administrator's Guide split into MPI and HPE chapters
18.2.1	Resources chapter in Reference Guide now in table format
18.2.1	New notation in command descriptions; see About PBS Documentation in any guide
18.2.1	New features no longer listed in User's Guide or Release Notes; instead see Administrator's Guide
14.2.1	New Hooks Guide; the Hooks Chapter in the Administrator's Guide has been removed.
13.1	Administrator's Guide contains a new Accounting chapter, and the previous Accounting chapter in the Reference Guide has been removed.
13.0	Installation and Upgrade Guide contains a new Communication chapter that describes the new pbs_comm daemon.
13.0	The Hooks chapter in the 13.0 Administrator's Guide has been overhauled. It also includes three new hook events.
12.1	User's Guide has been overhauled, with rewritten chapters on setting up the user's environment, submitting jobs, requesting resources, controlling the job, job arrays, and job file I/O.
12.0	Administrator's Guide chapter on Hooks is expanded and rewritten for the new execution-event hook feature. The "Setting File Transfer Mechanism" in the Administrator's Guide chapter on Administration is new for 12.0. Added "Initial Configuration" chapter to Installation & Upgrade guide for 12.0.

4 Bugs

4.1 Modifications and Bug Fixes in PBS 18.2.1

The following bugs are fixed in PBS 18.2.1:

Table 4-1: Bugs Fixed in PBS 18.2.1

JIRA Issue	Description
PBS-13043	Harden pbs_sched against assuming "Q" job arrays have queued subjobs without checking
PBS-14817	PBS Professional installer for Windows 7 Professional 64bit fails to install on node w/ DM + RGS
PBS-17573	engineering work for PP-617: acl_groups on queue considers only primary group
PBS-17717	Engineering work for PP-732: scheduler's attribute allows to control unset resources in placement sets
PBS-17737	%preun commands run during an upgrade deregistering PBS as a service
PBS-17804	-fPIC error while linking with libpbs.a
PBS-17987	engineering work for PP-764: sched attribute opt_backfill_fuzzy can't be set
PBS-18066	pbs_est should timeout after a configurable limit
PBS-18073	Upgrade ALM client library (ALSDK) to fix server deadlock
PBS-18290	Cloud bursting hook fails to run but says in the logs that it ran successfully
PBS-18397	Commercial license text to be displayed for commercial releases on "pbs_server.bin -t create" or qmgr; help
PBS-18411	Address PP-903: node limits are not working correctly with job equivalence classes feature
PBS-18434	Upgrade Python to 2.7.13 for Linux
PBS-19061	Engineering work for PP-1095: starting "pbs_mom -p" with running job results in SIGSEGV
PBS-19080	Docker and cgroup hook interoperability
PBS-19461	Cloud bursting hook fails to run if no nodes have been added to the server
PBS-19486	Setting any attribute thorough qmgr makes server crash if trial license file is used
PBS-19650	Burst fails and shuts down all nodes on a single node failure
PBS-19665	Cloud hook does not check to see if the default user exists on the pbs server before trying to clean the ssh keys
PBS-19778	cloud bursting hook bursts instances that cannot satisfy the job request
PBS-1978	cloud hook offlines nodes that it already offlined previously
PBS-20232	PBS server crash in leaf_timer_handler -> check_retries
PBS-20293	execjob_prologue hook getting executed twice with a pbsdsh request.

Table 4-1: Bugs Fixed in PBS 18.2.1

JIRA Issue	Description
PBS-20295	Do not power-off/ramp-down cray login nodes
PBS-20309	hook fail_action 'offline_vnodes' is not functional
PBS-20325	requested memory not considered by cgroups hook on CRAY
PBS-20327	cgroup hook crashes while discovering devices when files on /dev/shm tmpfs are deleted
PBS-20328	pbs_attach is supposed to attach session, not just PID, but cgroup execjob_attach attaches only PID
PBS-20329	pbs_cgroups hook do not work if memsw subsystem is disabled
PBS-20330	CUDA_VISIBLE_DEVICES as set in environment by cgroups hook must not have quotes
PBS-20332	Need option to disable unsafe memory fence creation in cgroup hook
PBS-20335	PBS daemons can be restricted by systemd version 226 and later TasksMax setting
PBS-20449	Removal of DNS records by PBS cloud bursting hook needs fix
PBS-20495	fix reservation parse_execvnode leak in scheduler

4.2 Modifications and Bug Fixes in PBS 14.2.5

Table 4-2: Bugs Fixed in PBS 14.2.5

JIRA ID	Summary
PBS-18820	moms cannot communicate with one another in a cloud configuration when cloud nodes resolve each other's hostnames to IP addresses not known to the PBS server/comm
PBS-18865	max_queued_res does not obey limit restriction for job arrays
PBS-19172	mom hook updates forgotten if acks not received before timeout
PBS-19177	Global-buffer-overflow at daemon_protect & Job Obit use memory after free
PBS-19199	Accounting E records show -2kb as the mem value in exec_vnode
PBS-19221	pbs_server crash inside of python garbage collection routines
PBS-19222	fix compiler warnings that may lead to memory corruption issues
PBS-19300	deleted job that was not cleared from list, causes server crash in post_discard_job()

4.3 Modifications and Bug Fixes in PBS 14.2.4

Table 4-3: Bugs Fixed in PBS 14.2.4

JIRA ID	Summary
PBS-17522	state_count queued jobs count goes negative after server restart
PBS-18078	Variable_List corruption when job is read from .JB file from disk
PBS-18157	It is possible to indefinitely delay the server ping_nodes using a client that registers/deregisters with pbs_comm
PBS-18172	MIN_STACK_LIMIT for stacksize not working for PBS Pro version 14.2.x
PBS-18373	pidcache to cull list of processes to poll in MOM polling is broken by PID recycling; pidcache_truncate doesn't allow for new kthreads
PBS-18457	qsub can crash based on -v value
PBS-18652	Upgrade to ALSDK 13.3.1

4.4 Modifications and Bug Fixes in PBS 14.2.3

Table 4-4: Bugs Fixed in PBS 14.2.3

JIRA ID	Summary
PBS-16681	pbs_est should time out after a configurable limit
PBS-17290	Sending large job scripts over TPP causes issues with TPP. Should use direct TCP connection in those cases.
PBS-17324	Tracejob output truncated on jobs using many vnodes
PBS-17535	mom's chk_file_sec messages missing when syslog is being used

Table 4-4: Bugs Fixed in PBS 14.2.3

JIRA ID	Summary
PBS-17558	Upgrade ALSDK to fix server deadlock
PBS-17562	pbs.PERIODIC is documented but not defined in python module
PBS-17860	mom execjob_begin hook alarms when running a large multi-node job

4.5 Modifications and Bug Fixes in PBS 14.2.2

Table 4-5: Bugs Fixed in PBS 14.2.2

JIRA Issue	Summary
PBS-15483	scheduler infinite loop after subjob fails to start on node
PBS-17802	Install test failure
PBS-17777	-fPIC error while linking with libpbs.a
PBS-17735	%preun commands run during an upgrade deregistering PBS as a service
PBS-17391	pbs_server has crashed (SIGABRT) when starting pbs_mom on a couple of racks (144 nodes) at the same time
PBS-17289	In high availability setup, "new" server leaf connection to pbs_comm keeps getting rejected because stale connection from old server is still seen
PBS-17280	Systemd PBS service startup times out if there are tens of thousands of jobs present
PBS-17205	logging via syslog does not work
PBS-17172	single or double quote in job env value, and the quote is not the last character in the value, causes qsub -V to lose env variable value as well as other variables when execjob_launch hook is present
PBS-17125	ACL and Array String attributes use memcpy for overlapping memory blocks
PBS-17105	only last SERVER hook of same kind (event) can modify PBS objects
PBS-17074	qdel not working with seq_num.server
PBS-17047	sgigenvodelist.awk script broken on RHEL6
PBS-17005	jobs not getting backfilled when server backfill depth is zero but queue is non-zero
PBS-16562	Server unresponsiveness can hang scheduler while resuming a job during a qdel -Wforce

4.6 Modifications and Bug Fixes in PBS 14.2.1

The following bugs are fixed in PBS 14.2.1:

Table 4-6: Bugs Fixed in PBS 14.2.1

JIRA Issue	Summary
PBS-7100	scheduler ignores node/queue association when node_group_key is only set at the server level
PBS-10770	Permission of /tmp on MOM not enforced w/o \$tmpdir in mom_priv/config
PBS-11091	module(s) missing in pbs_python causing import hashlib, no_md5 error
PBS-12763	PBS Server is restarting Python interpreter too often
PBS-13269	pbsnodes -l output trims the hostname to 20 characters
PBS-13379	pbs_postinstall creates db_user file in server_priv with wrong permissions
PBS-13658	Output from qstat -Bf is reporting a negative value for waiting jobs in state_count

Table 4-6: Bugs Fixed in PBS 14.2.1

JIRA Issue	Summary
PBS-13720	execjob_launch fails to setup the environment properly if one of the environment variables has a \n or a comma or quotes
PBS-14042	pbs_tclsh dumps core when called
PBS-14058	PBS schedules jobs on nodes w/o accounting for reservations
PBS-14109	After qordering the jobs, jobs are not considered in the correct order
PBS-14216	Invisible type custom resource is visible in the mails sent to job's mail recipient
PBS-14424	Problem with strict_ordering, jobs running when they shouldn't have
PBS-14499	Installer reports CentOS7 as unsupported platform
PBS-14517	Job attribute is not getting printed through execestost_periodic
PBS-14797	Hook throwing error 'SwigPyObject' object has no attribute 'name'
PBS-14832	Movement of job files now done in main PBS server thread and so can be blocked for very long time leading to server hangs
PBS-14842	PBS kills jobs that are suspended when the pbs_comm is restarted
PBS-14937	pbs.event().progname and pbs.event().argv settings are not remembered/propagated under multiple hooks
PBS-15218	Error when unsetting ncpus, that is ['ncpus'] = None, in modifyjob hook
PBS-15219	Deleting a subjob of a Job Array in User H state in Routing queue causes jobs to fail to route
PBS-15243	Introduce variable to set natural vnode to something else than hostname on MoM
PBS-15258	Server should record last known resource usage while requeueing due to down node
PBS-15271	Very slow preemption (or failure to preempt) when frequently hitting soft/hard limits in 13.0.x
PBS-15274	cpuset_destroy_delay waiting doesn't handle race conditions when stragglers create children
PBS-15307	Some libraries still cannot be used by customer in a shared object
PBS-15335	Hook debug causes file descriptor leak that crashes PBS server
PBS-15349	Sometimes suspended job does not resume after high priority job finishes even though sched_preempt_enforce_resumption is set
PBS-15355	Multi node job fails to start due to hung TPP client
PBS-15466	Pbs_spawn fails when user installed python path is passed rather than PBS Packaged python
PBS-15582	MoM crash when scanf() hits obscure kernel bug while reading unnecessary /proc/<pid>/stat fields
PBS-15592	Job with a root-owned script runs even if reject_root_scripts is set to true
PBS-15630	MoM Join-Job fails when PBS_LEAF_NAME is different from the default hostname
PBS-15641	Windows MoM could call pbs_demux.exe and mom_open_demux.exe w/ unsuitable shell if job sets Shell_Path_List
PBS-15650	Registering data service to systemd in /etc/init.d/pbs is broken on failover configs
PBS-15669	Error reporting code path fails to report all of the errors when setting entity count

Table 4-6: Bugs Fixed in PBS 14.2.1

JIRA Issue	Summary
PBS-15837	preemption not working for host level resources
PBS-15970	When error occurs while adjusting entity usage count for one limit, other limits/resources should be left unaffected
PBS-16004	commands and server performance problem in replying to PBS requests with replies larger than 1024 bytes
PBS-16431	PBS can hang if started initially with incorrect PBS_PRIMARY value
PBS-16760	long -lselect=... resources truncated by hook interface

4.7 Known Bugs, Errors, and Warnings

This section lists known deficiencies and warnings as well as unresolved problem reports filed by customers.

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-4196	mpiexec does not support the new SGI performance suite packages (formerly known as ProPack) Workaround: Edit the PBS mpiexec wrapper and replace the test for sgi-release with the equivalent of "true" or Use HPE SGI's mpiexec_mpt instead
PBS-10699	Directories that are staged in are not being cleaned up after the job completes execution.
PBS-11177	Job array subjobs are not being held after failing/requeueing 20 times.
PBS-12374	PBS cannot resolve job state inconsistency between server and MOM after node_fail_requeue
PBS-12531	If custom resource is named the same as formula keyword, formula will quietly use keyword
PBS-12589	non-inventory moms do not report PBSscrayhost or vntype
PBS-12683	Interactive job remains in R state forever after failed attempt to connect to job's host on windows
PBS-12689	When resuming a suspended job, the scheduler will recalculate but not alter the walltime
PBS-12813	The hook on execjob_end times out when using "pbs.server()"
PBS-12821	PBS Pro writing garbage characters in to accounting log entry which makes that record totally unusable for Analytics
PBS-12950	CPUSet not deleted if there are network issues during end of job processing Recommendation: Once identified, stop MOM with SIGINT, remove zombie from mom_priv/jobs, restart UV MOM with -p flag
PBS-12979	pbsnodes -o" offlines ALL vnodes/compute nodes on a Cray

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-12996	MOM-server/scheduler sync issue following overlay upgrade re: which jobs are "done" and can have cpuset destroyed.
PBS-13001	MOM in boot cpuset on linux_cpuset machines breaks socket licensing as "whole system" flag is not passed to hwloc Workaround: Temporarily start MOM in the root cpuset, and move it to the boot cpuset later.
PBS-13247	susp field is not getting updated in pbsnodes -SjL
PBS-13249	Mom hook runs periodically after the event is removed in qmgr
PBS-13260	the command pbs.server().scheduler_restart_cycle() does not restart the scheduling cycle. Workaround: Wait for a job to enter or exit the system.
PBS-13383	pbs_est hangs if holiday file is not complete Workaround: Add missing days.
PBS-13384	pbs_sched hangs with strict_ordering and backfill enabled - holidays file incomplete Workaround: Add missing days.
PBS-13448	PBS assigns jobs to offlined MoMs
PBS-13490	Lack of PBS_CORE_LIMIT in /etc/pbs.conf sets coredumpsize of job processes (soft and hard) to 0 Workaround: Specify PBS_CORE_LIMIT in /etc/pbs.conf
PBS-13517	IntelMPI wrapper support job launch fails when submitting large jobs
PBS-13584	tm_attach (pbs_attach) is unable to get the process user id when forked process is still owned by root
PBS-13603	Epilogue running at the same time as execjob_end for the same job
PBS-13639	pbs_mom is too quick to abort a job
PBS-13660	Can't access reservation Duration attribute in hook
PBS-13706	Preempted jobs fails to resume when the high priority job finishes because another job was scheduled on its resources
PBS-13712	unable to submit jobs on *nix if stagein filename contains '@' symbol
PBS-13715	Zombie jobs from reimaged nodes (when MOM loses PBS_HOME or gets corrupted files in jobs directory) Recommendation: Discover a zombie because users notice that the other jobs don't run, and either qrerun it (for rerunnable jobs) or qdel it.

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-13725	cpuset MOM fails to start exclhost multihost jobs Workaround: Don't use -lplace=exclhost when targeting cpuset MOM clusters
PBS-13792	PBS should better handle cpuset MOM resource availability that persistently does not match actual cpuset resource availability resulting in cpuset creation failures
PBS-13798	PBS has changed the contents of \$PBS_NODEFILE, now lists FQDN
PBS-13809	PBS Server hang, seemingly in internal license accounting
PBS-13873	Job array subjob state and array_indices_remaining can become inconsistent Workaround: Change the state in the datastore to make the subjob state and array_indices_remaining attribute consistent
PBS-14013	PBS_CONF_REMOTE_VIEWER configuration parameter (supported only on Windows) is not working appropriately
PBS-14051	High priority job which needs to preempt other jobs relevant to a limit cannot run through preemption if preemption candidates are using different resources.
PBS-14052	pbs_mom is not coming up after using /etc/init.d/pbs restart with running jobs on SLES 12
PBS-14059	Server and sched treat jobs in exiting state as "running" wrt resources_assigned vs. resources_available, but sched treats those jobs as "not running" wrt limits checks such as max_run_res. Workaround: Use resources_available for limit checking, but only works for PBS_ALL.
PBS-14111	PBS does not check for limits.pbs_comm file Workaround: Add a few lines to /etc/init.d/pbs
PBS-14147	Daemons should use malloc() to avoid Linux detuned malloc() behaviour, especially when there are memory leaks
PBS-14225	Hook error with queue.resources_available.keys()
PBS-14300	Scheduler hung while calendaring
PBS-14401	Execution node get autocreated even though it was deleted through qmgr
PBS-14421	Email is not getting triggered when a job fails during stage-in/stage-out
PBS-14494	Primary server takes a long time to come back up, after failover, when lots of jobs are in the queue
PBS-14820	server will almost always fail when attempting to abort a running job during start up
PBS-14833	Job script limit is lower than 1GB due to PostGreSQL, not 2GB Workaround: Avoid setting jobscript_max_size to something so large that it doesn't work.
PBS-14834	Scheduler dumps core for suspended job, when sched cycle is kicked, if requested vnode by job has been deleted
PBS-14998	Custom resources created in mom hook can sometimes cause server crash when mom sends job obit

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-15284	pbs_sched respawn on SEGV fails when abort() of original scheduler takes longer than 10 seconds Workaround: Run a cron job doing /etc/init.d/pbs start (or service pbs start, if appropriate, depending on platform) regularly.
PBS-15311	Jobs become zombies when the node is reimaged, the mom loses PBS_HOME or there are corrupted files in the job directory
PBS-15402	PBSPro failover secondary server fails to continuously check whether it needs to start a scheduler locally
PBS-15437	False failovers during job recovery caused by delays to do logging Workaround: Use softlinks to ensure that even when PBS_HOME is shared, the server log files are stored on local disk.
PBS-15442	scheduler error stating a custom resource may be invalid is incorrect due to case sensitivity
PBS-15484	node comments lost after pbs_server restart
PBS-15568	job ignores the delete request and rerun by scheduler (race condition)
PBS-15570	Cannot update estimated_start/vnodes job attributes of a suspended job Workaround: Increase max_starve to a value high enough so that the preempted jobs resume before being marked as starving.
PBS-15572	Scheduler incorrectly logs that jobs in reservation queues do not exist any more
PBS-15577	deleted custom resources which are added by exechoost_startup hook reappearing again after sending SIGHUP signal to mom
PBS-15579	Modifying multiple jobs with the same qalter command clobbers -W depend list Workaround: qalter jobs one at a time
PBS-15598	sched crash under certain circumstances when resource cases don't match
PBS-15961	Non-rerunnable job is not getting aborted as expected (intermittent)
PBS-15963	pbsdsh system errors when scaling to 1024 connections
PBS-16044	Address PP-448: max_run_res limits cannot be read from within queuejob hook
PBS-16091	invisible resources are printed in the server_logs and tracejob
PBS-16139	Queue resources_assigned.ncpus becomes negative and remains even after unset the attribute.
PBS-16368	Long Reservation Length goes negative
PBS-16573	finish_exec() called twice from mom_comm.c
PBS-16736	Secondary PBS server sometimes fails to stop
PBS-16783	log message about warning while reservations get confirmed is not visible anymore in server_logs
PBS-16839	On windows pbsdsh call fails to launch command and get the output on sister mom

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-16863	PBS_MOM_NODE_NAME not resolving hostname on windows
PBS-16962	Routing queues do not guarantee in-order routing, cause races when dependencies exist Workaround: No easy one. Admin intervention to temporarily raise limits for the user is usually necessary to break the deadlock.
PBS-17028	node_fail_requeue causes duplicate accounting records for job
PBS-17046	Scheduler may not mark a node for provisioning when it should be
PBS-17092	Job in substate 41 can't be deleted while in transit to MOM
PBS-17830	Unable to submit standing reservations if the actual time is between what was specified as -R and -E and gives error "pbs_rsub: Bad time specification(s)"
PBS-17844	PBS_NODEFILE doesn't include all vnodes
PBS-17896	Not all calls to pbs.server() in cgroup hooks are guarded with dotimeout(10,...)
PBS-17986	Unable to debug server periodic hooks with pbs_python
PBS-18060	Hooks run on MoM before server has sent updated resourcedef file can crash in _svr_types.py (uncaught exception) Workaround: Fix the Python code on site and remove the .pyc and .pyo files
PBS-18153	Jobs with multiple exit records in accounting log
PBS-18312	Jobs copies failing w/o any evidence of network issues
PBS-18552	Insufficient permission for scheduler logs for user
PBS-18601	MoM Hooks don't always run due to unreliable updates/copies
PBS-18661	"systemctl start pbs" fails when PBS_EXEC is not /opt/pbs
PBS-18744	FIFO not working with 14.x, especially when by_queue is false
PBS-18782	Spurious HELLO causes instantiated subjobs to fail to be sent to MoM
PBS-18804	qstat doesn't escape terminal control characters in environment variables
PBS-18815	pbs_habitat does not create directory structure for home if home folder already exists
PBS-18905	pbs_server munge errors in response to commands from remote hosts after reservation is deleted that has routing queues pointing to it
PBS-18926	PBS Pro sister moms do not clean up the job when the mother superior (diskless) get rebooted with a multi-node running job on it

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-19079	<p>cgroup hook and cpuset MoM process containment and suspend/resume interoperability</p> <p>Workaround:</p> <p>Disable the cpuset sbsystem, but this allows too much CPU usage <u>and</u> more importantly the fences that keep processes on the original socket</p> <p>Ensure that there is only one preempting job on each node</p> <p>Low hanging fruit: fix the cgroup hook to support at least per-socket process containment/pinning together with suspend/resume.</p> <p>If possible, also use cpu shares or cfs period/quota to prevent a job from using too much CPU if there are only per-socket fences and the socket is shared by more than one job.</p>
PBS-19124	<p>"hasnodes" attribute goes missing for queues when there are nodes binded to queue and the total_count of Jobs show negative</p>
PBS-19215	<p>pbs_comm not marking node down when there is job with substate 41</p>
PBS-19401	<p>cgroup execest_startup should synchronise resources_available.vntype to what is read from vntype file</p> <p>Workaround:</p> <p>Use qmgr to set the required vntype, and when it is updated offline the nodes until everything is indeed synchronised.</p> <p>The point is that many sites <u>DO NOT</u> get this right, and the fact that some things must be done using qmgr means that the server overrides what MoM is telling it, <u>hiding</u> any inconsistency quite well.</p>
PBS-19402	<p>cgroup hook race: systemd or Docker makes reading controller mount points from /proc/mount unreliable</p>
PBS-19530	<p>Changes to resolv.conf or nsswitch.conf are not reread in the PBS server without a restart</p>
PBS-19555	<p>pbsfs does not exit after printing message on invalid option used with it</p>
PBS-19561	<p>tm_attach broken by new pidcache for cpuset MoM on SGI NUMA machines; /proc and cpuset_move issues with TGID vs. TID</p> <p>Workaround:</p> <p>Build a pbs_attach wrapper that attaches itself to the correct cpuset before it tries to do a TM attach, but it needs to be setuid root and so it's a COLOSSAL security issue (one that the end customer will not countenance).</p> <p>It also only handles the pbs_attach scenario used by arrayd (not others where you try to attach sessions that already exist using pbs_attach -p).</p>
PBS-19562	<p>cpuset MoM on UV does not handle child cpusets of jobs</p>
PBS-19635	<p>Scheduler dumps core in reorder_nodes</p>
PBS-19697	<p>Stage directives can be evaluated</p>
PBS-19698	<p>heap corruption when PBS is started in an HA environment (i.e. via Pacemaker)</p> <p>Workaround:</p> <p>Setting MALLOC_CHECK_ in the environment (in an attempt to make the malloc library detect the issue) in the script that starts the server prevents the crash.</p>
PBS-19700	<p>pbsnodes -r does not update the node comment</p>
PBS-19783	<p>Scheduler considers suspended subjobs after queued subjobs</p>
PBS-19861	<p>sched crash in create_node_partitions</p>

Table 4-7: Open Bugs in PBS 18.2.1

JIRA Issue	Summary
PBS-19894	-Wumask does not work as expected in case -Wsandbox=PRIVATE is used
PBS-19905	Database backup shows multiple entries in the queue table for the same attributes
PBS-20102	all mom hook events run in a single iteration of the main mom loop are counted against job's walltime on Windows
PBS-20195	Array job comment gets appended with multiple "and finished" string after job_history_duration expiry
PBS-20226	pbs_est (and theoretically pbs_sched) use TCP connection to server which breaks after 1 hour (and neuters requests)
PBS-20273	Subjob in substate=41 in R state returns to Q state after Server restart and it can never run
PBS-20575	scheduler quasihangs because too many jobs are seen as preemption candidates (and other problems)
PBS-20593	Invalid initial resource update from MoM on job start if there's an execjob_begin hook present
PBS-20594	cgroups warning, more mem than vmem, if system doesn't have swap
PBS-20648	Syntax gets messed up while exporting shell functions with qsub -V
PBS-20649	Address PP-823: qsub -Wblock=true hangs server for 190 seconds per job at exit if submission host is unresponsive
PBS-20650	Address PP-822: Client not accepting response due to slow network hangs server
PBS-20651	misuse of qrun -H crashes server

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5.2 popen.c

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\$FreeBSD: src/lib/libc/gen/popen.c, v 1.14 2000/01/27 23:06:19

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5.6 hwloc

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5.7 editline

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5.8 MinGwEditLine

MinGwEditLine: <http://sourceforge.net/projects/mingweditline/>

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5.9 python-magic

(PBS 18.2)

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5.10 freebsd

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5.11 docopt.py

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