Moab HPC Suite 9.1.1 Release Notes

The release notes file contains the following sections:

- New Features
- Differences
- Installation and Upgrade Information
- Known Issues
- Resolved Issues
- Key Documentation Changes
New Features

This topic contains a summary of key new features in Moab HPC Suite.

In this section:

- General Suite
- Moab Workload Manager
- Moab Accounting Manager
- Moab Web Services
- Moab Insight
- Moab Viewpoint
- Torque Resource Manager

General Suite

This section contains information applicable to more than one of the components in the Moab HPC Suite.

9.1.0

New Automated Installer Method

An automated installer is now available to install your Moab HPC Suite components. Using this method, the whole installation process takes roughly an hour.

ℹ️ The automated installer method is not available for SUSE 11-based systems.

This method includes a user interface (web GUI) to let you easily plan your installation. For example, you can choose how many head nodes and which package to install and you will see the layout of your selected configuration. For example:
### New Features

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th>PRE-FLIGHT CHECKS</th>
<th>INSTALL</th>
<th>LICENSING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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**Supported Node 1**

- TORQUE - PBS Server

**Supported Node 2**

- Insight
- Databases
- MongoDB

- Enter a FQDN

- 3 Head Nodes + Compute Nodes
Once you have identified the configuration information (for example, the FQDN of the head node(s)), the automated installer will then generate the necessary scripts and begin the installation process. See Chapter 1 Automated installation Method for more information.

**Client Authentication Now Supports SHA-512**

Moab Workload Manager and Moab Web Services now support SHA-512 for message digests and message authentication codes. This support is in addition to the existing support for SHA-1.

- Moab Workload Manager has a new server checksum algorithm parameter named `SERVERCSALGO`. Valid values:
  - HMAC64: the default (SHA-1)
  - HMACSHA2: more secure (SHA-512)
- Moab Web Services has a new configuration parameter named `moab.messageDigestAlgorithm`. Valid values:
  - SHA-1: the default
  - SHA-512: more secure

If `SERVERCSALGO` is set to HMAC64, then `moab.messageDigestAlgorithm` must be set to SHA-1. Likewise, if `SERVERCSALGO` is set to HMACSHA2, then `moab.messageDigestAlgorithm` must be set to SHA-512.

### Moab Workload Manager

**9.1.1**

**Ability to Requeue a Job Asynchronously**

Jobs can be requeued asynchronously with `mjobctl -R --flags=force`.

**Added Node Count Per User Option**

`showq -u <username>` now displays a node count for the user.

**Check for Circular Dependencies No Longer Default**

Moab formerly checked job dependencies for circular dependencies. This check is now only performed if the `SCHEDCFG CHECKCIRCULARDEPENDENCIES` flag is set.

**Dynamic Assignment of Classes to Nodes**

Node class assignments formerly persisted until Moab was restarted. Class assignments can now be removed from nodes using `mnodectl -m cfgclass=\(<\text{CLASSES}\)`.

**Reservation Profiles Enabled for Standing Reservations**
New Features

A reservation profile for a standing reservation can be specified using SRCFG[] PROFILE=NAME.

**Parameter Specifies the "From" Address in Notification Emails**
The MAILFROMADDR parameter specifies an email address to be used in the From field in emails generated by Moab.

**9.1.0**

**Licensing by Sockets/Accelerators**
Moab now uses RLM licenses to provide better support for licensing by sockets and accelerators (NVIDIA GPUs or Intel MICs). Previously, licenses were generated based on the number procs. RLM licenses enable Adaptive Computing to generate licenses in better keeping with Moab's business model.

The new Moab "core" license will have a new name to reflect the RLM generation. Do not rename this license to moab.lic.

While the new Moab licenses use the RLM licenses technology, an RLM Server is not required to run most Moab functionality. Currently the only exception is if using the new Elastic Computing functionality, which will require a designated RLM to track usage.

The 9.1.0 licensing change does not affect legacy licenses; however, a new licensed may be required to use newer functionality.

**Elastic Computing Management**
Beginning with the 9.1.0 release, Elastic Computing now integrates with an RLM Server to track and report usage. This enables licenses by usage so that you are billed according to the total number of processor seconds used by the bursted (dynamic) nodes. Previously, Elastic Computing was licensed by number of nodes or sockets.

You can also limit over-bursting. For example, if your configuration allows 1000 processor seconds of use every day, then if a job needs to burst (and the used processor seconds reaches 1000 before the job can burst), the trigger to burst the job will not fire, and an error message is generated. You have the option to limit bursting by processor seconds or hours based on a maximum daily, monthly, quarterly, or yearly amount.

**Ability to Choose which Format to Write the Event File**
An EVENTFILEFORMAT configuration parameter has been added that lets you specify the format for the event file. Valid values are JSON, WHITESPACE, WIKI. The default is WIKI.

This change also deprecates the WIKIEVENTS configuration parameter.

**totalDedicatedProcessors Field Reports Processor Usage**
Moab now has includes totalDedicatedProcessors field that reports processor usage to MWS and Insight on a per-request basis.
New Features

**Pass Job ID to Elastic Trigger Script**
Elastic scripts have access to a $JOBID variable to obtain the job ID from Moab.

**Disable Backfill on a Per-Class Basis**
New Class Attribute credential "CLASSCFG[] FLAGS=NoBackfill" lets you disable backfill on a per-class basis.

**Moab Handles Resources Reported by the Torque Resource Plug-In**
Moab recognizes gres, gmetric, varattr, and feature resources reported by the Torque resource plug-in. If the resources show up in a ClusterQuery, their type will be preceded by a colon (for example, gres:<gres_name>=<gres_value>).

**Remove Nodes from Classes**
A node can be removed from a class using mnodectl -m CFGCLASS=<CLASS> <nodeexp>.

**New msub -n Option**
msub -n is added to support node exclusivity.

**createdDate Added to Block Messages**
A createdDate has been added to the job.blocks array for MWS and Insight.

**fullEnvironmentVariableList Job Attribute**
Moab now provides a fullEnvironmentVariableList job attribute to MWS and Insight that includes environment variables not included in the environmentVariables field.

**New USEMOABJOBID Job Flag**
The USEMOABJOBID job flag is available for job submission and job templates. This flag specifies whether to return the Moab job ID when running "msub", or the resource manager's job ID if it is available.

The USEMOABJOBID flag setting is set at the job level. When set, it overrides the (global) setting in moabcfg (Appendix A Moab Parameters).

**Administrator Policy for Max Preemption Count**
The JOBMAXPREEMPTCOUNT policy can be set to specify the number of times a single job can be preempted.

**showq Filter for Feature**
Enable "showq -w nodefeature=" to filter on node feature strings.
New Features

Job Blocked Processors and Processor Equivalents tracked in Accounting Manager
Moab now sends blocked processors and processor equivalents as job properties to the accounting manager so that they may be tracked and charged independent of the charge policy.

Reservation Reserved and Idle Processor Seconds tracked in Accounting Manager
Moab now sends reserved processor seconds and idle processor seconds as reservation properties to the accounting manager so that they may be tracked independently from the charge.

Requested Job Duration and Effective Queue Duration Reported to the Accounting Manager
Moab now sends the requested job wallclock limit (RequestedDuration) and the effective amount of time queued (QueueDuration) to the accounting manager for jobs. For these properties to be recorded in the MAM Usage Record, you must define custom usage record attributes in MAM for them.

Node Features Optionally Tracked in Accounting Manager
Moab can be configured to pass allocated node features as job properties to the accounting manager so they can be tracked and charged. The new AMCFG[] INCLUDEFEATURES parameter allows the option of sending feature counts or combinations on a per-node or per-task basis.

REQUIREDUSERLIST and REQUIREDACCTLIST for SRCFG
SRCFG[] has two new attributes REQUIREDUSERLIST and REQUIREDACCTLIST. Each of these takes a comma delimited list of users and accounts, respectively. When one of these is present any jobs that run in the reservation must match them. If both are present any job that runs inside the reservation must match both. It is recommended that any entries in REQUIREDUSERLIST and REQUIREDACCTLIST be present in the USERLIST and ACCOUNTLIST parameters to handle reservation affinities.

Command to Refresh LDAP Credentials Cache
mcredctl -r uid user::<UID> refreshes a user's UID and GID.

Reservation Profiles Can be Used for Standing Reservations
SRCFG[] PROFILE=<NAME> can be used to specify a reservation profile to be used for a standing reservation.

Moab Can Send Email from a Specified User
The MAILFROMADDR parameter can be used to specify an email address to go in the From field of emails Moab sends, so replies sent by recipients go to the specified address.

Commands to Display the Reason Jobs Are Blocked Or Deferred
showq -b -v and showq -b -v --blocking display the reason jobs are blocked or deferred.
New Features

Messages Showing a Resource Manager is Down Are Only Displayed to Admins
When a resource manager is down, the showq command only reports that the RM is down to admin users.

CLASSCFG[] MIN.TPN and MAX.TPN Used to Assign Jobs to Classes
If a job is submitted to a remap class, Moab attempts to determine the class to which the job belongs, based on the resources requested. MIN.TPN and MAX.TPN can be used to specify the minimum and maximum tasks per node for the job, respectively.

Moab Accounting Manager

9.1.1
Slurm Integration
Moab Accounting Manager provides integration with Slurm by including a contrib/slurm directory that includes charge and reserve integration scripts to be used in the Slurmctld epilog and prolog as well as a Slurm patch that enables Slurm to enforce a configured failure action when unable to obtain a lien with MAM. The documentation has been extended to include a new section on integrating with Slurm.

9.1.0
Web Services
Moab Accounting Manager Web Services (MAMWS) enables full access to the Moab Accounting Manager API via a REST-like interface over HTTPS. MAMWS communicates with Moab Accounting Manager using the same wire protocol, message format and Perl API as the MAM command-line clients and GUI interfaces. MAMWS forwards the required username and password (collected via HTTP Basic Authentication) to the MAM server for authentication and authorization. Thus, each user that wants to be able to use MAM Web Services must first set a password in MAM (e.g. with the mam-set-password client command). MAMWS runs under mod_perl from an Apache HTTP server.

New JSON DataType for Complex Object Properties
An attribute may have a DataType of JSON, which signals that it will store multiple complex values in the JSON object form: "{"<part_name>" : "<part_value>" , ...}". The part values can be extracted individually in a query with a --show option of the form: <attribute_name> {<part_name> } for certain client query commands having specifically added this support (e.g. mam-list-usagerecords, mam-shell). Added affiliated support for a new part attribute in MAM::Selection and MAM::Condition (as well the respective adders in MAM::Request). The use of par-
New Features

tial selections and partial conditions may only be used by MAM sites using a PostgreSQL database. Partial queries are not supported for sites using a MySQL database.

**New Usage Record Properties**

There is new support for the following as default or custom attributes in the usage record object:

*ExitCode.* A new ExitCode usage record attribute has been added to store a job’s exit code. The mam-charge, mam-create-usagerecord and mam-modify-usagerecord clients now provide a new `-x` `exit_code` option that will set the new exit code value in the usage record. This replaces the former custom CompletionCode usage record property. ExitCode must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords.

*Features.* Node features may now be tracked as a complex property. Features may be added as a custom usage record attribute to store the node features allocated by a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new `-F` "\"".""<feature_name>\"".""<feature_count>\",\",\",\"\"" option that will set the node features allocated by a job. The mam-list-usagerecords client can use the `--show` option to display the entire features list by specifying the Features attribute or an individual feature value by using the `<Features>` \"".""<feature_part_name>\""` syntax. Features must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords.

*Licenses.* Licenses may now be tracked and charged. A new complex Licenses usage record attribute has been added to store the licenses used by a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new `-L` "\"".""<license_name>\"".""<license_count>\",\",\",\"\"" option that will set the licenses used by a job. The mam-list-usagerecords client can use the `--show` option to display the entire licenses list by specifying the Licenses attribute or an individual license count by using the `<Licenses>` \"".""<license_part_name>\""` syntax. Licenses must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords. It is possible to charge for licenses by creating a charge rate using Licenses as the charge rate name and the license name as the charge rate value.

*Metrics.* Generic metrics may now be tracked and charged. A new complex Metrics usage record attribute has been added to store the generic metrics for a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new `-Z` "\"".""<metric_name>\"".""<metric_count>\",\",\",\"\"" option that will set the metrics for a job. The mam-list-usagerecords client can use the `--show` option to display the entire metrics list by specifying the Metrics attribute or an individual metric value by using the `<Metrics>` \"".""<metric_part_name>\""` syntax. Metrics must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords. It is possible to charge for generic metrics by creating a charge rate using Metrics as the charge rate name and the metric name as the charge rate value.

*Name.* Name may be added as a custom usage record attribute to store the user-specified job name. The mam-charge, mam-quote, mam-reserve, mam-create-usagerecord and mam-modify-usagerecord clients now provide a new `-n name` option that will set the new name value in the usage record. Name must
New Features

be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords.

RequestedDuration. A new RequestedDuration usage record property has been added to record the requested wallclock limit for a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new \texttt{-W \{\"<requested\_duration>\"\}} option that will set the total estimated wallclock duration for a job. The mam-list-usagerecords client can use the \texttt{--show} option to display the requested duration by specifying the RequestedDuration attribute. RequestedDuration must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords.

Resources. Generic resources may now be tracked and charged. A new complex Resources usage record attribute has been added to store the generic resources consumed by a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new \texttt{-R \{\"<resource\_name>\":\"<resource\_count>,\ldots\\}} option that will set the resources for a job. The mam-list-usagerecords client can use the \texttt{--show} option to display the entire resources list by specifying the Resources attribute or an individual resource count by using the \texttt{<Resources>{\"<resource\_part\_name>\}}} syntax. Resources must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords. It is possible to charge for generic resources by creating a charge rate using Resources as the charge rate name and the resource name as the charge rate value.

Variables. Job variables may now be tracked and charged. A new complex Variables usage record attribute has been added to store the job variables associated with a job. The mam-charge, mam-reserve, mam-quote, mam-create-usage-record and mam-modify-usage-record clients now provide a new \texttt{-V \{\"<variable\_name>\":\"<variable\_value>,\ldots\\}} option that will set the variables for a job. The mam-list-usagerecords client can use the \texttt{--show} option to display the entire variables list by specifying the Variables attribute or an individual variable value by using the \texttt{<Variables>{\"<variable\_part\_name>\}}} syntax. Variables must be added to the usagerecord.show string in the mam-client.conf file in order for this property to be seen in the default output in mam-list-usagerecords. It is possible to charge for job variables by creating a charge rate using Variables as the charge rate name and the complex variable (e.g. foo:bar) as the charge rate value.

Incremental Charging for Accumulating Usage Properties

Formerly, if you made an intermediate charge for an accumulating usage value such as cputime or energy, this value would be used in the charge as well as being stored in the usage record, but this could be mistaken for the cumulative value. Charge data now allows the specification of both the cumulative value and the incremental value, allowing you to make a charge for the incremental value while recording the cumulative value in the usage record.

Server Reconfig Option

After modifying configuration parameters used by the server, you can cause the server to reread its configuration by running \texttt{mam-server --reconfig} or by sending the HUP signal to the main server process.

Server Role Options
New Features

Two new options have been added to the server for improved support of high availability. The --primary option causes the server to start up in the primary server role. When running under the primary server role, events are enabled by default. The --backup option causes the server to start up in the backup server role. When running under the backup server role, events are disabled so they do not conflict with the primary server. If neither option are used, the server will attempt to determine its role by checking whether its hostname matches the server.host or backup.host entry in the site configuration file.

New --about Option on Clients
A new --about option has been added to the command line clients that displays product information including the product version, the revision number, the install directory, and the home directory.

New ExactMatch Filter Type for Fund Selection
A new ExactMatch filter type has been added to filter actions that involve selecting funds (Allocation Query, and Fund Deposit, Query, Reset, Stop and Withdraw). If the ExactMatch filter type is used, a fund will only be matched if the specified filters exactly match the fund constraints. This new filter type is now available in the following client commands: mam-balance, mam-deposit, mam-list-allocations, mam-list-funds, mam-modify-funds, mam-statement, mam-withdraw, and the contrib command: allocation-summary.

Data Types Returned With Responses
Responses that return data now also return metadata containing the data types for the data. This feature enables clients to better render the output appropriate to the data type.

Moab Web Services

9.1.0

Deleting a Job Now Accepts an Optional "Where" Condition
You can now specify a where condition to only delete the job if the where condition is satisfied. For example, to cancel the job only if it is idle, use where={"state": "IDLE"}. The only supported where condition is state.

New dedicateAllProcessors Field
The job requirements array has a new field: dedicateAllProcessors
Within a requirement, if dedicateAllProcessors is true, then all processors on the node where the job runs will be dedicated to the job.

New MWS Health Checks
The affected calls are /rest/diag/health/summary and /rest/diag/health/detail.
New Features

- Insight's Kafka communication; this call preparatory for the upcoming Reporting Engine functionality and is disabled by default
- Plugins
- Insight Server; also added in 9.0.2

#PBS Requirements Passed to Job
#PBS directives included inline with job scripts are processed server-side. This means that #PBS requirements will be passed to a job, provided they do not conflict with other defined job requirements in the web service call.

Support for Accounting Resources' "complex" Properties
In support of the new complex usage record properties sent by Moab to the accounting manager, the accounting usage record queries have added support for partial selections and conditions (e.g. rest/usage-records?query="variables":{"opsys":"linux" } &fields=id,licenses{matlab}&api-version=3&pretty=true).

New Resource to Retrieve License Information
MWS contains a new resource, /rest/diag/licenses, that retrieves license information from Moab Workload Manager.

New RLM License Plugin
The RLM plugin for MWS is available beginning with version 9.0.1. This plugin polls a Reprise License Manager (RLM) for purchased and available licenses for a given independent software vendor (ISV) and product. It reports this license information to Moab Workload Manager as a resource on the GLOBAL node.

Accounting Queries Support Field Comparison and Timestamps
For accounting resources, the query parameter now permits simple field comparisons including equal, greater than, greater than or equal, less than, less than or equal, and not equal. Additionally, queries based on time stamps are now supported. As an example, the enhanced query parameter syntax will support queries such as rest/accounting/allocations?query="endTime":{$gt:"2016-03-01 00:00:00 UTC" }.

Moab Insight

9.1.0

Archived Node Reliability and Retention
Insight now stores archived nodes in the Insight MongoDB database. By default, nodes will remain in the MongoDB database two years past the last time they have been reported by Moab Workload.
Manager. However, a new parameter (archiver.nodes.expireAfterSeconds) is available that lets you specify when the nodes will be deleted from the MongoDB database (to save disk space).

**Archived Reservation Reliability and Retention**

Insight now stores archived reservations in the Insight MongoDB database. By default, reservations will remain in the MongoDB database two years past their end date. However, a new parameter (archiver.reservations.expireAfterSeconds) is available that lets you specify when the ended reservations will be deleted from the MongoDB database (to save disk space).

**Performance Improvement in Job Sample Processing**

Job samples are now generated considerably faster.

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**Moab Viewpoint**

**9.1.0**

**Moab Pass-Through Support**

Moab passthrough support gives customers the ability to use Viewpoint and other modules provided by Adaptive Computing on top of third-party schedulers like Slurm.

**Set Min, Max, and Step Values for Resources**

When creating application templates, you can now set minimum, maximum, and step values for setting the number of cores, nodes with core count, malleable core count, total memory, and memory per core.

**Grid View Improvements**

The sessions page grid view has been enhanced to provide a cleaner user experience. The session name is displayed by the session screen shot and icons next to the screen shot represent session operations that may be initiated from the grid view.

**Colors Show Status of Nodes in Node List**

The status of nodes in the node list is indicated by color.

**Workload Tables Show Job Status By Color**

The queue status of jobs in the workload tables is indicated by color.

**Application Templates Can Request Malleable Cores**

Application templates allow users to request malleable core jobs (relates to Moab's TRL parameter).

**Allocated Node List Sorted and Role Indicated By Color**
New Features

The allocated node list in job details page has been improved to reflect actual allocation order, as well as adding coloring so users can more easily determine the role of each of the nodes allocated to the user's job.

**Job Messages Include Timestamp**
Job messages on the Job Details page display a date/time stamp to help users determine if the message information is relevant.

**Application Templates May Specify Total Memory Or Memory Per Core**
Application templates allow users to request either total memory for the job or memory per core.

**File Manager Configuration Page Includes A Connection Validation Test**
The configuration page for File Manager includes Test button that verifies whether the server parameters the user entered are correct.

**Search By Job Name On Workload List Page**
On the Workload List page, users can search for jobs by job ID, job name, or submitter name.

**New Default Roles and Changes to Role Permissions**
Viewpoint's role management page has been greatly simplified. Admins no longer have to specify domain permissions and can now use a tree navigator to more easily manage their user's permissions.

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**Torque Resource Manager**

**6.1.1**

**pbs_mom Switch to Force the Server to Accept a Hardware Update**
`pbs_mom -f` forces the server to accept an update of the hardware on the node. You should use this switch the first time you start the MOM after an upgrade.

**6.1.0**

**Added Presetup Prologue for MOMs**
The `presetup_prologue` executes before the MOMs attempt to set up jobs on the node. This prologue can be used, for example, to set up Kerberos.

**Added default_gpu_mode Server Parameter**
The `default_gpu_mode` server parameters sets the default value GPU mode. This should facilitate using CUDA 8.
New Features

Simplified Torque RPM Installation
The RPM installation no longer writes the server name into pbs_mom's config file, eliminating the need to configure the MOM config file in the default case.

Simplified Installation Process
"make install" and the package installer now install service/unit files, set up the path to the Torque libraries, and establish a shell path to binaries for sh and csh shells.

Resource Plug-In
There is now an API for creating resource plug-ins that report custom varattrs, generic resources, generic metrics, and features. Additionally, jobs can report custom resources through the plug-in.

-L Submission Recorded in the Accounting Log
Jobs submitted with the -L request syntax will now have the -L submission recorded in the accounting log.

NUMA-Aware cgroup Creation by Per Task or Per Job
A new Torque server parameter "cgroup_per_task" is available to let you specify whether cgroups are created per task or per job. The default is FALSE, meaning jobs submitted with the -L syntax will have one cgroup created per host; this behavior is similar to the pre-6.0 cpuset implementation.

The qsub/msub -L syntax is also modified to let you specify whether the cgroup is per task or per job at the job submission time.

Some MPI implementations are not compatible with using one cgroup per task.

Change hashname for a Torque Job to Match the Corresponding Moab Job ID
When jobs are submitted using qsub -J, the job's hashname is set to the job ID of the Moab job.

Job Arrays Now Only Partially Instantiated By Default
Job arrays are now only partially instantiated by default; additional idle jobs are added as the array is executed. This is controlled by the new idle_slot_limit server parameter.

A new qsub -i option has also be added to set the slot limit for the job array being submitted. If set for a non-array job, it will be rejected. If the user requests an idle slot limit that exceeds the server parameter's default, the job will be rejected.

Recover Array Subjobs
The new server parameter "ghost_array_recover" is added. pbs_server will now recover array subjobs even when the array (.AR file) couldn't be recovered. This parameter is set to TRUE by default.

Improved Job Cleanup Performance
New Features

The number of communications involved in job cleanup has been reduced, resulting in improved performance.

**Epilogue Script Runs, Even if Output Files Cannot Be Appended**
The epilogue script will now run when spool_as_final_name is configured, even if error and output files are not available and cannot be appended.

**Cray-enabled Torque May Also Be Configured With cgroups**
Cray-enabled Torque may also be configured with cgroups. On the login node, each job will have all of the CPUs and all of the memory controllers in its cgroup.

**Job Script Path is an Argument to Prologue and Epilogue Scripts**
A new positional parameter contains the full path of a job's job script to the job's prologue and epilogue scripts when the Torque pbs_mom "mother superior" launches the scripts. The prologue script is the new 8th positional parameter. The epilogue script is the new 11th positional parameter.

**RPM Install for SLES 12**
You can now use RPM to install and upgrade Torque on SLES 12.

**qrun Can Interpret the -L Syntax**
You can run jobs that request resources using *qrun* -L without a hostlist.

**User May Request No Emails be Sent, Even on Failure**
Specifying -m p at qsub time makes it so no emails are sent for the job, even on failure.

**User settable kill_delay Through qsub -K Option**
Added a user settable, per-job kill delay, called kill_delay. It is settable via the new qsub -K option.

**Torque Commands Appear in User's Login Shell Path**
RPMs created via build-torque now create /etc/profile.d/torque.sh (and torque.csh) files so that Torque commands appear in a user's login shell path.

**Option to Email User on All Non-zero Exit Codes**
The qsub -m f option sends an email if a job has a non-zero exit code. The qsub -m f option can be used with the a, b, and e options, but not with n or p.

**Added an Option for When to Send Mail Notifications**
Added a -m f option to qsub to send mail when a job terminates with a non-zero exit code.

**Option to Disable Reading of RUR Information**
New Features

Added $cray_check_rur configure option to disable reading of Resource Utilization Reporting (RUR) energy usage for Cray login nodes. If set to false, login MOMs will not look at the energy resource information used for each job. Disabling this may improve performance.

Improved Job Submission and Start Time Performance
Transactions per job submitted have been reduced from 11-13 to 3, improving job submission time by an average of 11-13%.

Added ghost_queue Queue Attribute
If pbs_server restarts and recovers a job but cannot find that job's queue, a new queue with the 'ghost_queue' attribute is created. That job is added and then run on the new queue. Jobs cannot be added to ghost queues. Once an administrator reviews and corrects the queue's settings, the 'ghost_queue' attribute can be removed, allowing the new queue to function normally.

New "email_batch_seconds" Server Parameter
The new server parameter "email_batch_seconds" lets you control at what frequency a batch of emails are sent to each user.

MOM Parameter to Overwrite Output Files
The $force_overwrite MOM parameter, if set to true, forces the output files to be overwritten each time a job is started.

Option to Turn Off trqauthd Logging
Added a -n option to trqauthd that disables trqauthd from logging anything.
Differences

This section contains differences in previously existing features that require a change in configuration or routine.

In this section:

- General Suite
- Moab Workload Manager
- Moab Accounting Manager
- Moab Web Services
- Moab Insight
- Moab Viewpoint
- Torque Resource Manager

General Suite

This section contains information applicable to more than one of the components in the Moab HPC Suite.

9.1.0

No known differences.

Moab Workload Manager

9.1.1

**LOGFILEMAXSIZE may be specified in MB or GB**

The default unit for the LOGFILEMAXSIZE parameter is bytes, but it can also be specified in mb, MB, gb, or GB.

**Sorting Order of Nodes in Rejection Summary**

When creating a summary of the reasons for rejection for a certain job, checkjob now lists the nodes in numerical order.

9.1.0

**EPEL Installation Changes for RHEL 6 and 7**
Installation of the EPEL RPM repository for Red Hat Enterprise Linux (RHEL) is no longer required. The RPMs that were being pulled form EPEL are now included in the Moab RPM download. Previously, EPEL was automatically installed by the install-rpm-repos.sh script.

**Nodes Listed in Numerical Order in checkjob Rejection Summary**
When listing the reason for rejection for a job, the `checkjob` command now sorts the list of nodes for a reservation in numerical order.

**Turn Off Idle Node Purging on a Per Node Basis**
For elastic computing, you can turn off the purging of individual dynamic nodes output using the varattr attribute in Torque or through the wiki interface.

**CHECKSUSPENDEDJOBPRIORIT Y Parameter Default Change**
The `CHECKSUSPENDEDJOBPRIORIT Y` parameter default is now FALSE.

>This change may affect additional parameters or flags that assumed `CHECKSUSPENDEDJOBPRIORITY` is set to TRUE.

**Changes to Base PE Calculations**
Base PE calculations are now on online resources, rather than total resources.

**showres Does Not Report Down or Idle Nodes**
`showres -f` does not include down or idle nodes in its output.

**Enhancement to the job.blocks Array (MOAB-8556)**
Added `createdDate` to the `job.blocks` array for MWS and Insight.

**Unset the MAXLOAD on a Specific Node with nodecfg**
Added ability to set MAXLOAD to -1 on a node to unset the default.

**Moved OutputFormat Tag into Job Tag**
The OutputFormat tag has been moved into the job tag so that usage of OutputFormat is XML compliant.

**Moab Handles qsub Job Arrays the Same as msub**
Moab now understands Torque job arrays the same as its own job arrays. Job arrays submitted to Torque will show up as job arrays in Moab.

**Documented Account Balance Cache Query (MOAB-8398)**
The command "mrmctl -q AccountBalanceCache AM" has been documented let you query Moab's internal account balance cache.
Changes to Job Accounting Properties Reported to the Accounting Manager

While Moab previously sent generic resources (including licenses), generic metrics and job variables as direct job properties to the accounting manager, Moab now sends generic resources, licenses, generic metrics and job variables in a consolidated form to the accounting manager under the Resources, Licenses, Metrics and Variables aggregate properties respectively. This change lets you distinguish the source of a property from among the disparate property types (including those having identical names) and limits the number of record properties needed to be configured within the accounting manager to track the desired aspects of the jobs.

Moab now additionally includes BlockedProcessors and ProcessorEquivalents as direct Job properties sent to the accounting manager instead of scaling the Processors charge by a consumptionRate attribute. This change allows these properties to be logged in the usage record, allows for better accuracy, and moves the control of what is being charged for into MAM. Moab now sends the exit code as ExitCode to the accounting manager (previously sent as CompletionCode). Moab now sends the hardware accelerators as GPUs and MICs (previously sent as Gpus and Mics). Moab now also sends RequestedDuration (requested wallclock limit) and QueueDuration (effective duration queued) to the accounting manager for jobs.

Configuration Changes Required to use Alternate Processor Charge Policies

Rather than specifying in Moab whether you want to charge for allocated processors, blocked processors, processor equivalents or cpu time, Moab now sends all of these resource usage properties to the accounting manager so that they may be tracked and charged independently.

- If you were using one of AMCFG[] CHARGEPOLICY=Debit{All,Successful} Blocked, comparable charging can be obtained by setting a charge rate for BlockedProcessors in Moab Accounting Manager.
- If you were using one of AMCFG[] CHARGEPOLICY=Debit{All,Successful} CPU, comparable charging can be obtained by setting a charge rate for CPUTime in Moab Accounting Manager.
- If you were using one of AMCFG[] CHARGEPOLICY=Debit{All,Successful} PE, comparable charging can be obtained by setting a charge rate for ProcessorEquivalents in Moab Accounting Manager.
- If you were using one of AMCFG[] CHARGEPOLICY=Debit{All,Successful} WC, comparable charging can be obtained by setting a charge rate for Processors in Moab Accounting Manager (which is the default).

See Managing Charge Rates in the Moab Accounting ManagerAdministrator Guide for examples on configuring charge rates for these alternate processor charge policies.

Job Charge Policy
Differences

A new AMCFG[] JOBCHARGEPOLICY parameter has been added that dictates the behavior of which jobs to track or charge with the accounting manager. This parameter permits values of All, None or Successful to enable charging of resources used for all, none or successful jobs respectively.

The related AMCFG[] CHARGEPOICY parameter is obsolete.

- If you were using one of AMCFG[] CHARGEPOLICY=DebitAll\{Blocked,CPU,PE,WC\} to track and charge for all jobs, comparable filtering can be obtained by using the new AMCFG[] JOBCHARGEPOLICY=All (which is the default).
- If you were using one of AMCFG[] CHARGEPOLICY=DebitSuccessful \{Blocked,CPU,PE,WC\} to track and charge for only successful jobs, comparable filtering can be obtained by using the new AMCFG[] JOBCHARGEPOLICY=Successful. Tracking and charging for jobs can also be disabled entirely by setting AMCFG[] JOBCHARGEPOLICY=none.

See Charging for Jobs in the *Moab Workload Manager Administrator Guide*.

Changes to Reservation Accounting Properties Reported to the Accounting Manager

Moab now includes IdleProcessorSeconds and ReservedProcessorSeconds as direct Reservation properties sent to the accounting manager; instead of scaling the Processors charge by a consumptionRate attribute.

These properties additionally include an increment attribute to differentiate between the charged processor seconds and the cumulative processor seconds (which is recorded in the usage record). These changes permit more accurate charging for reservation idle cycles, particularly when periodic charging is enabled. It similarly moves the control of the charging algorithm into MAM and allows for different charge rates to be used for jobs and reservations.

Configuration Changes Required to Continue to Charge for Reservations

The mechanism and configuration steps for charging for the unused cycles in reservations has changed.

If you were previously charging for reservations in Moab Accounting Manager, you will need to add the IdleProcessorSeconds and ReservedProcessorSeconds properties to the usage record object in MAM and adjust your charge rates to include a reservation-based charge rate for IdleProcessorSeconds in order to continue charging for reservations. See the example for Enabling Reservation Statistics (in Customizing the Usage Record Object) and see the example for Charging for the unused cycles in reservations (in Creating Charge Rates) in the *Moab Accounting Manager Administrator Guide* for how to do this.

Reservation Charge Policy

A new AMCFG[] RESERVATIONCHARGEPOICY parameter has been added that dictates the behavior of tracking or charging for the total and unused cycles in a reservation with the accounting manager. This parameter permits values of All, None or Select to enable charging of unused cycles for all, none or select reservations respectively.

The related AMCFG[] ALWAYSCHARGERESERVATIONS parameter is now deprecated.
If you were using AMCFG[] ALWAYSCHARGERESERVATIONS=True, comparable functionality can be obtained by using the new AMCFG[] RESERVATIONCHARGEPOlicy=All.

If you were using AMCFG[] ALWAYSCHARGERESERVATIONS=False, comparable functionality can be obtained by using the new AMCFG[] RESERVATIONCHARGEPOlicy=Y=Select.

See Charging for Reservations in the Moab Workload Manager Administrator Guide.

Changes to Reservation Statistics

Current blocked processor seconds (cbps, STATCBPS), current reserved processor seconds (crps, STATCRPS), total blocked processor seconds (tbps, STATTBPS) and total reserved processor seconds (trps, STATTRPS) have been added as new reservation statistics and have been added to the ODBC database schema.

Current active processor seconds (caps, STATCAPS), current idle processor seconds (cips, STATCIPS), total active processor seconds (taps, STATTAPS) and total idle processor seconds (tips, STATTIPS) are no longer reported in the reservation statistics and have been removed from the ODBC database schema. The former active processor seconds statistics are roughly equivalent to the new blocked processor seconds statistics and the former idle processor seconds statistics are roughly equivalent to the new reserved processor seconds statistics minus the new blocked processor seconds statistics.

Added UseRMCompletedJobStats SCHEDCFG Flag

Use RM reported CPUTime when calculating job efficiency with SCHEDCFG[] FLAGS-S=UseRMCompletedJobStats.

Configuration Changes Required to Distinguish Licenses from Generic Resources when sent to the Accounting Manager

It is now possible to distinguish licenses from generic resources when they are reported to the accounting manager. Any generic resources seen on nodes reported via a native resource manager having the server configuration parameter RMCFG[] RESOURCE_TYPE=License will be consolidated under the new Licenses property of the job. License generic resources defined in Moab may be identified as license types by using the Moab configuration parameter GRES_CFG[] LICENSE=TRUE.

LIMITEDJOBACP Now Has a Default Value of TRUE

Checkpointing on a per job basis can negatively affect Moab on systems with many jobs. To avoid this performance impact, LIMITEDJOBACP now has a default value of TRUE, which means Moab will only checkpoint a job when the state changes.

Ability to the Specify Path with the Log Level

The mschedctl -L command has a new format of [<LOGLEVEL>[:<LOG_FILE>]]. In addition to specifying the level for which you want to save log messages, you can specify the path where you want to save those log files.
Differences

Moab Accounting Manager

9.1.0

MySQL Use Deprecated
The use of a MySQL (or MariaDB) database as the backend database for MAM is deprecated. Beginning with this release, some features (such as partial queries) may not be available when using a MySQL database. Support for MySQL may be removed in a future release. If you are using a MySQL database for your MAM backend, it is highly recommended that you migrate the MAM database from MySQL to PostgreSQL and reconfigure Moab Accounting Manager to use the PostgreSQL database.

Configure --with-user Defaults to mam
Configure has changed to use mam as the default accounting admin userid if not specified via the --with-user option. Previously, configure would use the user running the configure command as the default accounting admin userid.

Re-enabled Support for the Raw Format
Support for the raw format in query client commands has been re-enabled. When using the --format=raw option, output fields are delimited with a pipe (|) symbol.

Sample Allocation Summary Report Provided
A sample allocation summary report that summarizes the status of current and expired allocations has been added to the contrib directory. By default, it will display fund constraints and allocation and usage details for the currently active allocations. If a timeframe is given, both active and expired allocations overlapping the specified time period will be displayed. Filters can be specified to narrow the set of allocations displayed. Specific fields can be specified for display. A totals line is displayed unless you are using the csv or raw format. Additional fields include the number of jobs and reservations charged, processor-seconds used, and percent of idle reservation cycles used.

Custom CompletionCode Usage Record Attribute Changed to ExitCode
Previously, Moab would send the exit code via the CompletionCode usage record property, which would have optionally been added as a custom property. Moab has been modified to send the exit code by default in the new ExitCode usage record property. If the database migration script detects a CompletionCode usage record property, it will rename the usage record property to be ExitCode, otherwise a new ExitCode usage record property will be created.

Disk No Longer Included as Default usagerecord Property
The Disk property has been removed from the default display list for usage records (usagerecord.show) and is no longer added as a usage record attribute for new installations. It can still be added as a custom
Differences

attribute, and support still exists for the -D <disk> option in the various commands to manipulate it. Disk is not removed as a usage record attribute from existing installations.

CPUTime No Longer Included in Default Display List for Usage Records

The CPUTime property has been removed from the default display list for usage records (usagerecord.show). However, it is still created as a default usage record attribute for new installations. It simply needs to be added to the default display list for mam-list-usagerecords by editing the the usagerecord.show parameter in the client configuration file (mam-client.conf).

Incremental Values Can Be Specified in Charge-Related Actions

It is now possible to specify both the incremental as well as the cumulative values for an accumulating usage property in charges, liens and quotes, making it possible for you to charge for the incremental value while recording the cumulative value in the usage record. The usage record property XML data permits a new increment attribute in support of this feature. Additionally, the mam-charge, mam-reserve, and mam-quote clients allow a new syntax for accumulating properties of the form: [<cumulative_value>] {[<incremental_value>]}.

Enhancements to the MAM Perl API

The new MAM::Datum->addProperty method has been added as an alternative to MAM::Datum->setProperty which replaces similarly named properties. MAM::Request->set{Object,Selection,Assignment,Condition} methods have been renamed to MAM::Request->add{Object,Selection,Assignment,Condition} as a more consistent description of what the functions do.

Improved Handling for Server Termination

When the server is shutdown via mam-server --shutdown,-k, it now logs the termination in the server log. Additionally, if the TERM signal is sent to the main server process, the pid file will be removed, the termination will be logged, and the server process will be ended.

-R Charge Rate Option Renamed to --rate charge_rate in Client Commands

All clients using the former -R charge_rate_name[{{charge_rate_value}}]=charge_rate_amount,... option have been changed to use the new --rate charge_rate_name [{{charge_rate_value}}]=Icharge_rate_amount,... option in order to support the new -R {"resource_name":resource_count,...} option. This change affects the mam-charge, mam-reserve, and mam-reserve clients.

-E email_address Option Renamed to --email email_address in Client Commands

The former -E email_address option has been deprecated in favor of the new --email email_address option in order to facilitate the new -E energy option. This change affects the mam-create-user and mam-modify-user clients.
Differences

-F phone_number Option Renamed to --phone phone_number in Client Commands
The former -F phone_number option has been deprecated in favor of the new --phone phone_number option in order to facilitate the new -F feature_name:feature_count,... option. This change affects the mam-create-user and mam-modify-user clients.

The Effect of the -t Option in mam-charge, mam-reserve, and mam-quote Has Changed
The -t option was previously used to express the incremental charge, lien, or quote duration. However, in the mam-create-usagerecord and mam-modify-usagerecord, -t was used to express the total actual duration. Additionally, there was no direct way in mam-charge, mam-reserve, and mam-quote to set the total actual duration (one had to use -X Duration=<actual_duration>). A new -zt option has been added to mam-charge, mam-reserve, and mam-quote to specify the incremental charge, lien, or quote duration. The -t option in mam-charge has been changed to indicate the total actual duration. As it is not applicable to set the total actual duration for a quote or lien, the -t option has been removed from mam-quote and mam-reserve. This change is expected to have low impact because most calls of the charge, lien, and quote actions occur through the wire protocol or via the API, and in the typical use case for calling mam-charge directly to make up for missed charges, the previous method for setting the total actual duration (-X Duration=<actual_duration>) still works as previously. Using the new -t option in the same way as previously has the same overall effect when making non-incremental charges.

The Effect of the -s Option in mam-charge, mam-reserve, and mam-quote Has Changed
The -s option was previously used to express the charge, lien, or quote start time. However, there was no direct way to express the original start time for the usage (one had to use -X StartTime=<start_time>). A new -zs option has been added to mam-charge, mam-reserve, and mam-quote for incremental charging. The -s option in mam-charge and mam-reserve has been changed to set the original start time for the usage. As it is not applicable to set the original start time for a quote, the -s option has been removed from mam-quote. This change is expected to have low impact since the former way of setting the original start time (-X StartTime=<start_time>) will still work as previously. Using the new -s option as previously has the same overall effect when making non-incremental charges.

The Effect of the -e Option in mam-charge, mam-reserve, and mam-quote Has Changed
The -e option was previously used to express the charge, lien, or quote end time. However, there was no direct way to express the final end time for the usage (one had to use -X EndTime=<end_time>). The -e option in mam-charge has been changed to set the final end time for the usage. As it is not applicable to set the final end time for a lien or quote, the -e option has been removed from mam-reserve and mam-quote. This change is expected to have low impact since the former way of setting the final end time (-X EndTime=<end_time>) will still work as previously. The new use of the -e option will have a similar overall effect as previously when making non-incremental charges.
The Effect of the -d Option in mam-charge, mam-reserve, and mam-quote Has Changed

The -d option was previously used to annotate a description in the charge, lien, or quote transactions. The -d option now annotates a description in the usage record. This change is deemed to be more useful and is better aligned with the use of the -d option in the mam-create-usagerecord and mam-modify-usagerecord clients.

Events Enabled by Default

The event scheduler is now enabled by default.

Allocations and Notifications Refreshed Via Events

New events have been created to explicitly refresh allocations and notifications instead of doing this as a side-effect of queries. This enables queries to avoid obtaining a request ID and allows them to be run on a read-only database replica.

Events Disabled for Backup Server

Since both the primary and backup servers may run simultaneously, events are disabled for the backup server so they do not conflict with events triggered by the primary server.

The super.user Server Configuration Parameter Has Been Removed

Actions requiring escalated (super user) privileges should always use the configured primary accounting admin user, which defaults to mam but may be overridden with configure --with-user.

Moab Web Services

9.1.0

The Insight Database Query API is No Longer Available

The /rest/insight resource is no longer available. Use the ViewpointQueryHelper plugin instead.

/mws/rest/diag/licenses Resource Now Returns Elastic Usage Information

In addition to the existing license information, the /mws/rest/diag/licenses resource now returns Elastic usage information (such as daily, monthly, and yearly processor seconds).

New Fields for Job Resource

These fields were added to the jobs resource:

- blocks.partition
- dependencies.count
Differences

- durationMinimum
- partitionAccessListScheduler
- rank

**Changes to Reservation Statistics**

Blocked processor seconds (blockedProcessorSeconds) and reserved processor seconds (reservedProcessorSeconds) have been added as new reservation statistics. The current active processor seconds (caps), current idle processor seconds (cips), total active processor seconds (taps), and total idle processor seconds (tips) are no longer reported in the reservation statistics.

The new blocked processor seconds value is roughly equivalent to the sum of what was previously reported as the current active processor seconds and total active processor seconds. The new reserved processor seconds value is roughly equivalent to the sum of what was previously reported as current active processor seconds, previous total active processor seconds, current idle processor seconds, and total idle processor seconds.

**Deprecation of Accounting Resources**

With the advent of the new MAM Web Services component in Moab Accounting Manager, the services available through Moab Web Services for interacting with objects in Moab Accounting Manager are deprecated. The MWS Accounting resources and services will not be enhanced and may be removed in a future release.

**Moab Insight**

**9.1.0**

**Finer Granularity for Job Sample Pruning**

Job sample records in Insight's MongoDB will be pruned such that granularity is high for recent samples but low (once per day) for samples older than one month.

**Insight Can Now Run on Secure Sites**

Insight no longer requires execute privileges in the /tmp directory, which is not allowed in some secure sites.

**Insight Now Uses MongoDB Instead of PostgreSQL**

Insight no longer requires access to both PostgreSQL and MongoDB. This makes the installation and management process of Insight a lot simpler. Performance improvements are expected from this and other changes.

**Moab Viewpoint**
9.1.0

Additional Base Roles

Viewpoint now configures with six default (base) roles. The HPCAdmin and HPCUser are the same as they were in previous Viewpoint versions. The other four roles are:

- NitroAdmin – Administrative user, with permission to create Nitro application templates and manage other user's Nitro jobs.
- NitroUser – Basic user, with permission to create and manage their own Nitro jobs.
- RemoteVizAdmin – Administrative user, with permission to create remote visualization application templates and manage other user's remote visualization jobs.
- RemoteVizUser – Basic user, with permission to create and manage their own remote visualization jobs.

All six default roles are present regardless of whether your configuration includes Nitro or Remote Visualization.

Torque Resource Manager

6.1.1

$CUDA_VISIBLE_DEVICES is not set by default

$CUDA_VISIBLE_DEVICES is not set by default if you're using cgroups. Also, this makes its contents compatible with varying CUDA versions.

6.1.0

Use --enable-cgroups Recommended; --enable-cpusets is Deprecated

--enable-cgroups is the recommended configuration option. When cgroups are supported, cpusets are handled by the cgroup cpuset subsystem.

--enable-cpusets is deprecated; meaning that the functionality is still supported; however, no new features will be added.

pbs_server Does Not Shut Down When trqauthd is Stopped

The trqauthd service is no longer a requirement of pbs_server, so pbs_server no longer shuts down when trqauthd is stopped.

TorqueConfigure Script Does Not Enable the GUI Component
Differences

When the devel-tk and devel-tel libraries have been installed, the Torque configuration script does not enable the GUI component. To build the GUI component, specify --enable-gui when building from source.

**Default Value for keep_completed Parameter Changed**

The default value for the Torque keep_completed parameter has been changed to 300 seconds. The keep_completed parameter specifies the number of seconds jobs are kept in the job execution queue after they are completed. Keeping completed jobs in the queue enables Torque to report on the status of the jobs.

**legacy_vmem Server Parameter Affects Behavior of the -l vmem Option**

legacy_vmem is a new server parameter that affects the behavior of the -l vmem option. When set to true, the vmem request will be the amount of memory requested for each node of the job. When it is unset or false, vmem will be the amount of memory for the entire job and will be divided accordingly.

**Queue Support for Both resources_default.* and req_information_default.* Settings**

When queues have both resources_default.* and req_information_default.* set then they are applied according to their resource request type. resources_default.* settings are applied to jobs that do not explicitly use the -L syntax, while req_information_default.* settings are applied only to jobs that explicitly use the -L resource syntax.

**Prohibited Mode Not Allowed for User Jobs**

Setting the compute mode of an NVIDIA GPU to prohibited makes it so the GPU cannot be used at all. In previous versions of Torque users were allowed to set a GPU to prohibited mode. But then it could not set the mode to anything else since the GPU was now prohibited. This change went into effect for version 5.1.3, 6.0.2, and later.

**Cray-Enabled Torque May Be Configured with cgroups**

Support is added for Cray-enabled Torque configured with cgroups.

- On the login node, each job will have all of the cpus and all of the memory controllers in it's cgroup.

**Support for Single Job Dependencies and Array Dependencies at the Same Time**

Jobs can depend on single job dependencies and array dependencies at the same time.

**Added a Way to Exclude Compute Nodes From allow_node_submit.**

Set 'allow_node_submit=true' in qmgr, and then add a remote mom to node_submit_exceptions with 'set server node_submit_exceptions = <nodename>' in qmgr. This setting will disable job submissions on the <nodename> specified by the user. Previously, the process of disallowing compute nodes from submitting jobs would require making a separate entry in qmgr for each individual compute node.
Reduced the Number of Logging Statements
Reduced the number of logging statements when a node isn't up and therefore can't receive the mom hierarchy.

Added tcp_incoming_timeout Server Parameter
tcp_incoming_timeout specifies the number of seconds before incoming connections timeout. tcp_timeout now specifies the timeout for outgoing connections or connections initiated by pbs_server. tcp_incoming_timeout functions exactly the same as tcp_timeout, but governs incoming connections while tcp_timeout governs only outgoing connections (or connections initiated by pbs_server).

pbs_server Enhancement for Very Large Number of Jobs.
pbs_server has been enhanced to better handle a very large number of jobs (several hundred thousand or more) by enabling an alternate way for it to store job-related files in the directories $PBS_HOME/server_priv/jobs and $PBS_HOME/server_priv/arrays.

A new boolean server attribute, use_jobs_subdirs, lets an administrator direct the way pbs_server will store its job-related files. When use_jobs_subdirs is unset (or set to false), job and job array files will be stored directly under $PBS_HOME/server_priv/jobs and $PBS_HOME/server_priv/arrays. This is the default behavior and the way the server has stored these files in the past. When use_job_subdirs is set to true, job and job array files will be distributed over 10 subdirectories under their respective parent directories. This method helps to keep a smaller number of files in a given directory.

If an administrator wishes to change the use_jobs_subdirs attribute from its previous value (or when setting it to true when it has not previously been set), it is highly recommended that Torque be drained of all jobs. Failing to take this action may result in the loss of existing jobs.
Installation and Upgrade Information

This section identifies information useful when installing and upgrading.

When installing or upgrading, it is strongly recommended that administrators configure Moab with mauth authentication with a complex key value. See Mauth Authentication in the Moab Workload Manager Administrator Guide for more information.

In this section:

- Compatibility Requirements
- Installing Moab 9.1.1
- Upgrading to Moab 9.1.1

Compatibility Requirements

For the 9.1.x release, all Moab HPC Components are compatible with other 9.1.x versions. Compatibility with prior versions (such as 9.0.x) is not supported; however exceptions can occur between Moab Workload Manager and Torque Resource Manager.

The following identifies additional information regarding compatibility:

- Torque Resource Manager and Moab Workload Manager
  - If you are using Torque 6.1, you must run Moab 8.0 or later. However, if running Moab less than 9.1, the following Torque functionality will not be available.
    - NUMA-aware scheduling and cgroup support; requires Moab 9.0 or later.
    - Torque plugin, requires Moab 9.1 or later.
  - Moab supports Torque version 4.29 or later.
- Moab Web Services and Moab Workload Manager
  - Moab Web Services does not support SUSE 11-based systems. The Moab Server Host on which you will also install MWS needs to have a MWS-compatible OS.

Installing Moab 9.1.1

Please see the Moab Installation and Configuration Guide for manual or RPM-based installation instructions.

Upgrading to Moab 9.1.1

Please see the Moab Installation and Configuration Guide for manual or RPM-based installation instructions.
Known Issues

This topic lists known issues in Moab. Following each issue description is an associated issue number in parentheses. Known issues are aggregated and grouped by the release version for which they were first reported.

In this section:

- General Suite
- Moab Workload Manager
- Moab Web Services
- Moab Accounting Manager
- Moab Insight
- Moab Viewpoint
- Torque Resource Manager

General Suite

9.1.0

- If the new, automated installer falls mid-install, Apache may not have been configured correctly. As a result, when you run the automated installer again, you may see an error that the Apache restart failed. If you see this error, uninstall Apache and then run the automated installer again. (DOC-3022)

Moab Workload Manager

9.1.1

- Moab fails to start; error "Could not find a valid RLM license (base license keyword 'moab_license'): System clock has been set back (-40)". A script is available to correct this problem. Contact your Adaptive Computing account manager to resolve this issue. (DOC-2977)

9.1.0

- Certain multi-node/multi-task jobs submitted using the new -L syntax will start correctly but on subsequent iterations the tasks per node will revert to 1. (MOAB-8718)

Moab Web Services
Known Issues

**9.1.0**

No known issues.

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Moab Accounting Manager

**9.1.0**

No known issues.

---

Moab Insight

**9.1.0**

No known issues.

---

Moab Viewpoint

**9.1.0**

- When migrating jobs to Torque from Viewpoint, Moab will translate the request into the equivalent `qsub` command with the proper `-l procs` syntax. In some situations, Torque's queues may have been configured with a `default_resources.nodes` setting that is incompatible with the job's `-l procs` request. In this situation, the `default_resources.nodes` setting should be removed from the queue or the job should be submitted to a queue that does not have a `default_resources.nodes` setting.

- There is a known issue in RHEL/CentOS 7.2.1511 and 7.3.1611 ([https://bug-s.centos.org/view.php?id=12722](https://bug-s.centos.org/view.php?id=12722)) where the pip generates a Traceback in the pyparsing package. Check the version of pyparsing that is installed. Install pyparsing 2.0.3 or later. Either run 'yum update', 'yum update pyparsing', or locate and install pyparsing 2.0.3 or later.

- Job arrays sometimes do not expand to show subjobs correctly on the Workload and Node Details pages. (IRIS-2949)

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Torque Resource Manager

**6.1.1**

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Known Issues

- Updating pbs_server when GPU jobs are running can result in job issues. Make sure no GPU jobs are running before updating pbs_server. (DOC-3132)

6.1.0

- `qstat -f` accounting logs sometimes report "resources_used.vmem=0". This is due to how Linux reports memory usage. (TRQ-3760)
- Torque will not compile when the tk-devel and tcl-devel packages are installed on the host. To work around this, disable building of the gui component by using --disable-gui when executing configure. (TRQ-3723)
Resolved Issues

Resolved issues are aggregated and grouped by the release version in which they were resolved. When applicable, each resolved issue has the associated issue number in parentheses.

In this section:

- Moab Workload Manager
  - Moab Accounting Manager
  - Moab Web Services
  - Moab Insight
  - Moab Viewpoint
  - Torque Resource Manager
  - Automated Installer

## Moab Workload Manager

### 9.1.1

- mam-charge-retry.pl script failed for array jobs. (MAM-388)
- NODESET definition in a class overrode reservation affinity. (MOAB-8903)
- Moab was not creating standing reservations on all partitions by default. (MOAB-8888)
- Jobs with an invalid minwclimit were causing Moab to crash. (MOAB-8863)
- mdiag -S --xml did not display 5-minute statistics, as it did in non-xml mode. (MOAB-6896)

### 9.1.0

- Moab was not reporting the correct task count for jobs that allocate ALLPROCS. (MOAB-8847)
- The systemd file generated with the --prefix option was not using the specified path. (MOAB-8727)
- systemd was terminating the active Moab server instead of the local Moab server. (MOAB-8667)
- Scheduler Analysis Block Reasons section displayed duplicate messages. (MOAB-8657)
- Task count was incorrect when requesting generic resource scheduling (GRES) on the global node. (MOAB-8627)
- Moab block messages were not always informative. (MOAB-8612)
- If jobs with a custom name were canceled, subsequent jobs with a similar custom name failed. (MOAB-8661)
- Jobs were rejected when requesting NUMA resources and NODEACCESSPOLICY-Y=SINGLEJOB. (MOAB-8565)
Resolved Issues

- msub did not allow you to specify a working directory, as with qsub -w <path>. (MOAB-8551)
- The class of GPU jobs that request more than one task was not being mapped correctly. (MOAB-8538)
- DPROC was not being calculated correctly on GPU jobs. (MOAB-8536)
- mcredctl was not reporting variables in credentials. (MOAB-8510)
- Jobs place on hold or batchhold were not being correctly recognized as being on hold. (MOAB-8433)
- Requeuing a job that was restarting caused it to be canceled. (MOAB-8422)
- Requesting a node's name as a feature prevents other jobs from getting that node. Jobs that request node names as features will now be placed on hold. (MOAB-8420)
- Issues reported for groups, users, and accounts with spaces in the name. Enabled SCHEDCFG[] FLAGS=AllowCredentialsWithSpaces to let Moab ignore POSIX standards and allow groups, users, and accounts with spaces in the name. (MOAB-8399)
- Jobs with the "AFTER" dependency were not auto-cancelling. (MOAB-8387)
- Job ID collisions were occurring in a grid environment. (MOAB-8385)
- Fixed issue with multi-req jobs and "EnforceReservedNodes". (MOAB-8105)
- In a Master/Slave grid configuration, the Master Moab did not honor the TTL attribute of jobs running on the slave node. (MOAB-7871)
- mdiag -C gave an error when specifying an SRCFG GRES resource. (MOAB-7547)

Moab Accounting Manager

9.1.1

- Future (DEPTH>1) liens did not charge the correct allocation. (MAM-390)
- mam-charge-retry.pl script failed for array jobs. (MAM-388)

9.1.0

- Events did not log notifications to the Notification table by default, as documented.
- MAM GUI sometimes failed after an RPM upgrade due to changed ownership of the GUI log file. (MAM-373)
- Clients using the mamauth promotion method were intermittently returning an empty digest and signature causing the failure message "Incoming digest does not match calculated digest." (MAM-372, MAM-379)
- Multi-chunk queries sometimes caused server to time out and client to hang. (MAM-361)
- An event alarm scoping problem resulted in client "Connection reset by peer" failures, and in rare occasions by server failure. (MAM-340)
- The systemd unit file did not use the correct sbin directory for ExecStart. (MAM-338)
Resolved Issues

Moab Web Services

9.1.1
- MWS could not handle a large volume of messages from ZMQ. (WS-2554)

9.1.0
- During a POST to /mws/rest/jobs, MWS now returns a 400 error if tasksPerNode field is defined but taskCount is not defined. (WS-2504)
- CPUPTime in accounting usage record was being rendered as a date-time. (WS-2469)
- Field does not appear in the MWS job field documentation. Added javadoc for job field "submitCommandFile". (WS-2454)
- The MWS health check page did not correctly indicate LDAP DNs errors. (WS-2442)
- Performance when loading large LDAP trees with many attributes needed improvement. (WS-2254)

Moab Viewpoint

9.1.1
- File Manager now considers all groups to which a user belongs when making decisions on access rights. (Previously, it only considered the user's primary group.) (IRIS-3161)

9.1.0
- File Manager displayed no feedback message after a copy/move operation. (IRIS-2593)
- When uploading files, File Manger overwrote files with the same name. (IRIS-2591)
- File Manager displayed an internal server error when a user without read permission attempted to read a file or its details. (IRIS-2542)
- File Manager did not handle Unicode file and directory names correctly. (IRIS-2511)
- Custom job submission script disappeared when Esc was pressed to exit the script editor. (IRIS-2450)
- Graphs on Home page were not displaying correctly when internet access was limited. (IRIS-2449)
- Create Job returned unclear error message when the ID of a new job matched the ID of an existing job. (IRIS-2355)

Moab Insight
Resolved Issues

9.1.0

- Insight filed to process messages from Moab that had unexpected fields. (IN-507)

Torque Resource Manager

6.1.1

- Command-line directives did not override submit filter directives for interactive jobs. (TRQ-3862)
- GPU models k40s and k80s were not detected correctly when using GPUs and cgroups. (TRQ-3861)
- stdout was not properly delivered on NFS file systems when Torque was configured with --disable-spool. (TRQ-3792)
- Torque was not allocating resources correctly for cgroup jobs. (TRQ-3790)
- Torque was not waiting for a compute node to do a copy out process. (TRQ-3762)
- Fixed node locking issues that were causing pbs_server to abort when built with newer versions of the threading library. (TRQ-3755)
- Server build was failing with --disable-spool configure option. (TRQ-3751)
- Forced requeue command (qrerun -f) was not obeying kill_delay settings. (TRQ-3737)
- When adding a dynamic node, the server was initially putting the node in free state, but not reporting this state to the server. (TRQ-3733)
- The memory cgroup was not being set correctly for jobs requesting pmem and procs. (TRQ-3728)
- Jobs were not being removed from node_usage files after ending. (TRQ-3727)
- Jobs were becoming stuck after not starting correctly. (TRQ-3720)
- pbs_server aborted under ghost array recovery when job array files were missing. (TRQ-3719)
- momctl was not displaying the $varattr script or the correct time and date. (TRQ-3712) (TRQ-3617)
- pbs_mom crashed when started on the reporter node without $apbasil_protocol set in the config. (TRQ-3715)
- Torque was not allocating enough memory controllers to satisfy memory requests. (TRQ-3681)
- pbs_server was not being properly shut down when in HA mode. (TRQ-3670)
Resolved Issues

- pbs_server was not detecting and updating total_threads when a node's hyperthreading was enabled. (TRQ-3662)
- pbs_server was not properly restarted when running "service pbs_server restart" during installation. (TRQ-3657)
- Memory and swap limits were not set in cgroup. For information on how memory and swap options are used, see 1.1 -L NUMA Resource Request in the Torque Resource Manager Administrator Guide. (TRQ-3656)
- Jobs submitted with -l option with exclusive access to the node were not receiving all CPUs and memory controllers in the cgroup. (TRQ-3649)
- Corrected logging to only log that a signal is sent to a process when it is actually issued. (TRQ-3638)
- pmem was not getting set correctly. With cgroups enabled, pmem is the amount of resident memory allocated per process where are process is given by the value of ppn. For example: `qsub -l nodes=1:ppn=2,pmem=250mb` will allocate a total of 500 MB on the node where the job is run, 250 MB per ppn. (TRQ-3628)
- NUMA -L syntax defaulted to override user-specified parameters. (TRQ-3623)
- `qstat -x` returned nothing (instead of an empty XML document) when there are not jobs queued. (TRQ-3622)
- Jobs in which a task required more than one socket could not be started using NUMA -L syntax. (TRQ-3618)
- $usecp parameter was ignored when specifying which directories should be staged. (TRQ-3613)
- Server deadlocked when job_save() failed. (TRQ-3605)
- Tasks' memory usage was sometimes not reported. (TRQ-3601)
- Interactive jobs skipped submit filter directives if the first line was not #PBS. (TRQ-3585)
- Client commands were not attempting to contact the fallback server when the primary server was down. (TRQ-3582)
- Crash/infinte loop when loading certain node usage files. (TRQ-3576)
- Issue reported with alps login nodes. Updated cpusets for alps login nodes so that all of the cpus are in the job's cpuset. (TRQ-3568)
- Torque crashed intermittently when using the -L syntax. (TRQ-3566)
- Torque was not reporting nodes in the correct order. (TRQ-3559)
- Torque returned non-specific network failure messages to Moab. (TRQ-3539)
- Completed jobs were still reported in pbsnodes. (TRQ-3525)
- A deadlock occurred when handling job dependencies. (TRQ-3519)
- cgroup directories were not removed when jobs were completed. (TRQ-3515)
- drmaa unable to link with Torque. (TRQ-3511)
- Memory calculation issues reported when cgroups enabled and -l vmem|pmem|mem are used. (TRQ-3499)
- Epilogue not showing up in momctl -d3 output. (TRQ-3495)
Resolved Issues

- Job dependencies were not being cleared with High Availability server. (TRQ-3477)
- Array subjobs did not have a queued entry in the accounting log. (TRQ-3470)
- Segfault in create_alps_subnode with node_note populated. (TRQ-3445)
- Problems with clearing a node note. Removed length restriction on a node note. (TRQ-3439)
- Jobs that never ran were receiving end records. (TRQ-3432)
- Array templates were being reported as jobs. (TRQ-3405)
- A shell escape in pbs_mom's config file when specifying GRES did not show up in pbsnodes or Moab. (TRQ-3393)
- Resources_used.walltime changed to seconds from HH:MM:SS in accounting logs. (TRQ-3385)
- libtorque.so was not being created. (TRQ-3374)
- pbs_server timed out connection to pbs_mom. Added load balancing to login nodes when they start to get busy. (TRQ-3367)
- pbs_mom would hang when sending status from a child. Added a timeout for node health check scripts so that they cannot make the mom daemon hang. (TRQ-3364)
- pbs_mom hangs on restart with init script. Ensured that necessary services have been brought up before starting the Torque daemons and that the Torque daemons are shutdown before their required services are shutdown. (TRQ-3345)
- Numbered directories in server_priv/jobs (and arrays) were missing when the server attribute use_jobs_subdirs was set to TRUE. (TRQ-3185)
- qrls gave no response and logged no problem when a failure occurred due to a slot limit restriction. (TRQ-3328)
- Fixed a memory leak when jobs were being started asynchronously. (TRQ-3326)
- qsub -W stage-in was not working. Fixed failures where the group name showed up in the log as the problem but the user did not belong to the group name given in the error. (TRQ-3312)
- Multiple moms sent invalid destroy_alps_reservation/req_delete_reservation. Only allows one kill orphaned reservation request per reservation at one time. (TRQ-3299)
- Problems building RPMs on Red Hat 6/CentOS 6 systems. (TRQ-3283)
- Jobs with square brackets in the name were aborted on restart if they weren't array subjobs. An issue was fixed with jobs getting aborted if they are named with "[]" in the name but aren't Torque array jobs. (TRQ-3214)
- Logs filled with messages about not sending hierarchy to mom. Failures are only logged the first time it can't send the hierarchy to a mom. (TRQ-3156)
- Jobs started even if mother superior could not resolve the hostname for a sister node. (TRQ-3134)
- qsig was not working correctly when display_job_server_suffix = false. (TRQ-3102)
- Error condition where the mom's port would be inserted into the .JB file name. (TRQ-3090)
- Torque was not able to release holds on job arrays. Running qrls on an array subjob allows pbs_server to correct slot limit holds for the array to which it belongs. (TRQ-3088)
Resolved Issues

- Down/offline nodes caused TORQUE to not online elastic nodes. pbs_server is now able to bring up new nodes even when there are nodes in the system that are down or offline. (TRQ-3066)
- Completed jobs were not getting cleaned up. Fixed various issues when restarting dependency jobs, including them not getting removed even after completion. (TRQ-3175)
- Several log messages were unclear. (TRQ-2860)
- qsub -v was not processing environment variables with no value correctly. (TRQ-2699)
- Node recovers when behind processing requests. pbs_server now detects when a node is failing too frequently and mark it down temporarily if this happens. Once a node is marked down, it will be marked up again if either two consecutive communications from pbs_server to the node receive successful replies, or after five minutes of staying offline (whichever comes first). A node is considered to be failing too frequently if it has three failures to reply to a server request without have two consecutive successes in between. (TRQ-2517)
- qstat -f was not displaying init_work_dir. (TRQ-2459)
- Job holds were not updated when the slot limit was changed for a job array. (TRQ-2360)
- Torque enabled unused scheduler_iteration parameter by default. (TRQ-2161)

Automated Installer

9.1.1

- CentOS 7.3.1611 introduced the following bug: https://bugs.centos.org/view.php?id=12722. The Automated Install installs a newer version of pyparsing as a workaround. (INST-59)
- Ansible install preflight check failed on RHEL-6 saying "No package libffi-devel available." (INST-54)
- mdiag -l showed no license because installer incorrectly names the Moab license file. (INST-21)
- Moab was not configured to use usage-tracking mode when accounting was enabled. (INST-18)
- Jobs were not seen in Viewpoint Workload – Insight was configured incorrectly when installed on a separate host. (INST-15)
Key Documentation Changes

This topic lists some key documentation changes made for Moab HPC Suite 9.1.1.
Features new to this release have been documented but are not listed on this page. For information about those new features and links to their respective documentation, see New Features.

In this topic:

- Moab Workload Manager
- Torque Resource Manager
- Installation and Upgrade Guide
- Online Help

Moab Workload Manager

This section lists documentation changes made for the release. Documentation changes that resulted in a revised document before the next release can be found in Documentation Changes in the Moab Workload Manager Administrator Guide.

**9.1.1**

- Document existing EnforceNodeSet reservation flag.
- Update default/tested values for MMAX_ATTR, MMAX_CLASS, MMAX_FSDEPTH, MMAX_QOS, MMAX_RACK, MMAX_REQ_PER_JOB.
- Document existing JOBACCTIONONNODEFAILUREDURATION parameter.

**9.1.0**
N/A

Torque Resource Manager

This section lists documentation-related changes to the Torque Resource Manager Administrator Guide.

**6.1.1**

- Add notes regarding --enable-geometry-requests is not compatible with --enable-cgroups.

**6.1.0**
N/A
Key Documentation Changes

Installation and Upgrade Guide

This section lists documentation changes made for the release. Documentation changes that resulted in a revised document before the next release can be found in Documentation Changes in the Moab HPC Suite Installation and Configuration Guide for information on documentation changes made between releases.

9.1.1

- Installing MWS (manual and RPM method) – Remove redundant information for bind_ip.

9.1.0

- New chapter for using the new automated installer.
- Changes to the Identify the Manual or RPM Installation Methods topic to include information about the new automated installer.
- MongoDB database 3.2.x requirement, instructions for installing and upgrading the database.
- Insight no longer uses a PostgreSQL database (deprecated in 9.0.2).
- Additional configuration information regarding using multiple RLM servers.
- Post-installation instructions for disabling the Adaptive Computing repository.
- Compatibility requirements section is improved to explain differences in compatibility between Moab and Torque version.

Online Help

This section lists documentation changes made for the release.

To access the online help, click the ? icon in the toolbar.
Key Documentation Changes

9.1.1/6.1.1
N/A

9.1.0/6.1.0
Improvements have been made for searching the online documentation. In addition to the search filter sets added in 9.0.1, information is available on how to specify the search terms to limit the results displayed.