Microway Training for San Diego State University
SLURM installation and administration
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===================**SLURM CentOS 7 cluster installation instructions**=====================

Download latest stable version of slurm (www.schedmd.com/downloads.php)
Move compressed file to `/root/rpmbuild/SOURCES`
Uncompress file in the SOURCES directory:
```
tar -xvf slurm-18.08.7
```

Look at the build options in the slurm.spec file
```
vim slurm.spec
```
Use these options:
--with hdf5
--with hwloc
--with lua
--with mysql
--with numa
--with openssl
Additional packages will need to be installed first in order to include this extra functionality
For example:
```
scom-parallel yum install -y hdf5 hdf5-devel
scom-parallel yum install -y hwloc-devel hwloc-libs
scom-parallel yum install -y lua lua-devel
scom-parallel yum install -y qt-mysql perl-DBD-MySQL akonadi-mysql
scom-parallel yum install -y numa numad numactl-libs numactl-devel
scom-parallel yum install -y openssl openssl-libs openssl-devel

#run above installations on compute nodes as well: scom-parallel yum install <packages>
```

Build the source rpm using those options:
```
rpmbuild --with <> --with <> … -bb slurm.spec
```
Rpms that were built are automatically placed in RPMS directory. You will want to install all of these on the master node, and some of them on the compute nodes. To make this easy, we copy all of the rpms in a directory that is NFS-mounted across the whole cluster.
```
  cp /root/rpmbuild/RPMS/x86_64/slurm-* /mcms/slurm/built
```

Add slurm user and directories before installing:
```
useradd -d /var/spool/slurmd -M -u 200 -r slurm
mkdir -p /var/spool/slurmd
mkdir -p /var/lib/slurmd
mkdir -p /var/log/slurmd
mkdir -p /var/run/slurmd
chown -R slurm:slurm /var/spool/slurmd
chown -R slurm:slurm /var/lib/slurmd
```

```
chown -R slurm:slurm /var/log/slurmd
chown -R slurm:slurm /var/run/slurmd
```

Run this on the compute nodes as well. We have a script which can be used to automate this:
```
scom-nodes-parallel /mcms/slurm/add-user-and-directories.sh
```

Install **all** of the rpms on the head node:
```
cd /mcms/slurm/built ; yum install *.rpm
```

Compute nodes will need munge installed. Munge is the default authentication mechanism used by SLURM. The 'epel-release' linux package repository must be added first so that munge can be installed from that repo
```
Scom-parallel yum install -y epel-release
Scom-parallel yum install -y munge munge-devel munge-libs
```

Generate a key for munge
```
cd /etc/munge
dd if=/dev/urandom of=munge.key bs=1c count=4M
```

Copy that key to the compute nodes:
```
scpf munge.key /etc/munge/
```
Note: scpf does an scp to all of the nodes in a node list (default is /etc/nodes)

Change ownership and permissions of the key to munge:
```
scom-parallel chown munge:munge /etc/munge/munge.key
scom-parallel chmod 600 /etc/munge/munge.key
```

Enable the munge system service on **all** nodes:
```
scom-parallel systemctl enable munge
scom-parallel systemctl start munge
```

You only need to install some of the slurm rpms on the compute nodes
```
scom-nodes-parallel "cd /mcms/slurm/built/ ; yum install -y slurm-18.08.7-1.el7.x86_64.rpm
slurm-libpmi-18.08.7-1.el7.x86_64.rpm slurm-pam_slurm-18.08.7-1.el7.x86_64.rpm
slurm-perlapi-18.08.7-1.el7.x86_64.rpm slurm-slurmd-18.08.7-1.el7.x86_64.rpm
slurm-torque-18.08.7-1.el7.x86_64.rpm"
```

Start with a template `slurm.conf` configuration file, and modify it based on your existing nodes and desired configuration. Most parameters can be left at defaults.
`slurm-example-configs-18.08.7-1.el7.x86_64.rpm` will install an example `slurm.conf.example` file in /etc/slurm which can be used as a template.
You can also use the easy configurator https://slurm.schedmd.com/configurator.easy.html which will generate a slurm.conf file for you.

Note: you can use `slurmd -C` on a node to generate configuration for that particular node, and add that to `slurm.conf`
Distribute that file to all nodes (head and compute)

Enable and start the slurm system services on head node first

```
systemctl enable slurmctld
systemctl enable slurmd
systemctl start slurmctld
systemctl start slurmd
```

Check the status of the services:
```
systemctl status slurmctld
systemctl status slurmd
```

Then enable and start slurmd service on compute nodes
```
scom-nodes-parallel systemctl enable slurmd
scom-nodes-parallel systemctl start slurmd
```

==========Slurm.conf configuration and allocating nodes to specific user groups ===============

- If you have different logical user groups (e.g. Math, Physics, CS departments) that you would to exclusively allocate resources for, this can be done easily
- Use the `AllowGroups=<group>` parameter in the Partition definition
- For example, in `/etc/slurm/slurm.conf`:

```
PartitionName=PHYSICS     Priority=10000 MaxTime=3000:00 State=UP Nodes=node2
AllowGroups=physics
```

```
PartitionName=admin     Priority=65535 Default=YES MaxTime=3000000:00 State=UP Nodes=node[1-2]
AllowGroups=slurmadmin
```

Add a group using the mcms command which creates an LDAP group:

```
mcms_group_add <OPTIONS> <GROUP NAME>
```

Add a user using the mcms command which creates the LDAP user and assign them to a group:

```
mcms_user_add --groups <GROUP1,GROUP2> <USER NAME>
```

Add existing user to a group:

```
mcms_user_mod --groups <GROUP1,GROUP2> <USER NAME>
```

See the groups that a user belongs to:

```
groups <USER>
```

==========Updating slurm==================

To install a newer version of slurm (for example to go from version 17.11.13-2 to 18.08.7-1), go through the normal build process for the version that you want to install (follow the same steps as above for slurm 18.08.7-1). Then simply install those rpms as normal and yum should handle upgrading automatically.

WARNING: Do not upgrade to a version that is greater than one point release newer than the one you are currently running. For example, don't upgrade from major point release 16.x.x-x to 18.x.x-x, upgrade to 17.x.x-x first and then to 18.x.x-x.

Stop the slurmctld and slurmd services first using `systemctl stop <service>`
See command example with output (command was run on a single compute node. Should also run on the rest of the compute nodes, and also install on the head node):

```
[root@node1]# cd /mcms/slurm-built
[root@node1 slurm-built]# ls
16.05.5    slurm-18.08.7-1.el7.x86_64.rpm          slurm-example-configs-18.08.7-1.el7.x86_64.rpm
slurm-pam_slurm-18.08.7-1.el7.x86_64.rpm  slurm-slurmd-18.08.7-1.el7.x86_64.rpm
17.11.13-2  slurm-contribs-18.08.7-1.el7.x86_64.rpm  slurm-libpmi-18.08.7-1.el7.x86_64.rpm
slurm-perlapi-18.08.7-1.el7.x86_64.rpm    slurm-slurmdbd-18.08.7-1.el7.x86_64.rpm
18.08.7-1   slurm-devel-18.08.7-1.el7.x86_64.rpm     slurm-openlava-18.08.7-1.el7.x86_64.rpm
slurm-slurmctld-18.08.7-1.el7.x86_64.rpm  slurm-torque-18.08.7-1.el7.x86_64.rpm
[root@node1 slurm-built]# yum install *rpm
Loaded plugins: fastestmirror
Examining slurm-18.08.7-1.el7.x86_64.rpm: slurm-18.08.7-1.el7.x86_64
Marking slurm-18.08.7-1.el7.x86_64.rpm as an update to slurm-17.11.13-2.el7.x86_64
Examining slurm-contribs-18.08.7-1.el7.x86_64.rpm: slurm-contribs-18.08.7-1.el7.x86_64
Marking slurm-contribs-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-devel-18.08.7-1.el7.x86_64.rpm: slurm-devel-18.08.7-1.el7.x86_64
Marking slurm-devel-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-example-configs-18.08.7-1.el7.x86_64.rpm: slurm-example-configs-18.08.7-1.el7.x86_64
Marking slurm-example-configs-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-libpmi-18.08.7-1.el7.x86_64.rpm: slurm-libpmi-18.08.7-1.el7.x86_64
Marking slurm-libpmi-18.08.7-1.el7.x86_64.rpm as an update to slurm-libpmi-17.11.13-2.el7.x86_64
Examining slurm-openlava-18.08.7-1.el7.x86_64.rpm: slurm-openlava-18.08.7-1.el7.x86_64
Marking slurm-openlava-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-pam_slurm-18.08.7-1.el7.x86_64.rpm: slurm-pam_slurm-18.08.7-1.el7.x86_64
Marking slurm-pam_slurm-18.08.7-1.el7.x86_64.rpm as an update to slurm-pam_slurm-17.11.13-2.el7.x86_64
Examining slurm-perlapi-18.08.7-1.el7.x86_64.rpm: slurm-perlapi-18.08.7-1.el7.x86_64
Marking slurm-perlapi-18.08.7-1.el7.x86_64.rpm as an update to slurm-perlapi-17.11.13-2.el7.x86_64
Examining slurm-slurmctld-18.08.7-1.el7.x86_64.rpm: slurm-slurmctld-18.08.7-1.el7.x86_64
Marking slurm-slurmctld-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-slurmd-18.08.7-1.el7.x86_64.rpm: slurm-slurmd-18.08.7-1.el7.x86_64
Marking slurm-slurmd-18.08.7-1.el7.x86_64.rpm as an update to slurm-slurmd-17.11.13-2.el7.x86_64
Examining slurm-slurmdbd-18.08.7-1.el7.x86_64.rpm: slurm-slurmdbd-18.08.7-1.el7.x86_64
Marking slurm-slurmdbd-18.08.7-1.el7.x86_64.rpm to be installed
Examining slurm-torque-18.08.7-1.el7.x86_64.rpm: slurm-torque-18.08.7-1.el7.x86_64
Marking slurm-torque-18.08.7-1.el7.x86_64.rpm as an update to slurm-torque-17.11.13-2.el7.x86_64
Resolving Dependencies
--> Running transaction check
---> Package slurm.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm.x86_64 0:18.08.7-1.el7 will be an update
---> Package slurm-contribs.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-devel.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-example-configs.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-libpmi.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm-libpmi.x86_64 0:18.08.7-1.el7 will be an update
---> Package slurm-openlava.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-pam_slurm.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm-pam_slurm.x86_64 0:18.08.7-1.el7 will be an update
---> Package slurm-perlapi.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm-perlapi.x86_64 0:18.08.7-1.el7 will be an update
---> Package slurm-slurmctld.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-slurmd.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm-slurmd.x86_64 0:18.08.7-1.el7 will be an update
---> Package slurm-slurmdbd.x86_64 0:18.08.7-1.el7 will be installed
---> Package slurm-torque.x86_64 0:17.11.13-2.el7 will be updated
---> Package slurm-torque.x86_64 0:18.08.7-1.el7 will be an update
--> Finished Dependency Resolution
```

```
Dependencies Resolved

================================================================================
================================================================
 Package                         Arch                      Version
Repository                                       Size
================================================================================
================================================================
Installing:
 slurm-contribs                  x86_64                    18.08.7-1.el7
/slurm-contribs-18.08.7-1.el7.x86_64                31 k
 slurm-devel                     x86_64                    18.08.7-1.el7
/slurm-devel-18.08.7-1.el7.x86_64                 363 k
 slurm-example-configs           x86_64                    18.08.7-1.el7
/slurm-example-configs-18.08.7-1.el7.x86_64        6.4 k
 slurm-openlava                  x86_64                    18.08.7-1.el7
/slurm-openlava-18.08.7-1.el7.x86_64               24 k
 slurm-slurmctld                 x86_64                    18.08.7-1.el7
/slurm-slurmctld-18.08.7-1.el7.x86_64              3.7 M
 slurm-slurmdbd                  x86_64                    18.08.7-1.el7
/slurm-slurmdbd-18.08.7-1.el7.x86_64               2.3 M
Updating:
 slurm                           x86_64                    18.08.7-1.el7
/slurm-18.08.7-1.el7.x86_64                         54 M
 slurm-libpmi                    x86_64                    18.08.7-1.el7
/slurm-libpmi-18.08.7-1.el7.x86_64                444 k
 slurm-pam_slurm                 x86_64                    18.08.7-1.el7
/slurm-pam_slurm-18.08.7-1.el7.x86_64             497 k
 slurm-perlapi                   x86_64                    18.08.7-1.el7
/slurm-perlapi-18.08.7-1.el7.x86_64                3.2 M
 slurm-slurmd                    x86_64                    18.08.7-1.el7
/slurm-slurmd-18.08.7-1.el7.x86_64                 2.3 M
 slurm-torque                    x86_64                    18.08.7-1.el7
/slurm-torque-18.08.7-1.el7.x86_64                367 k

Transaction Summary
================================================================================
================================================================
Install  6 Packages
Upgrade  6 Packages

Total size: 67 M
Is this ok [y/d/N]: y
```

Then start the slurmctld and slurmd services.