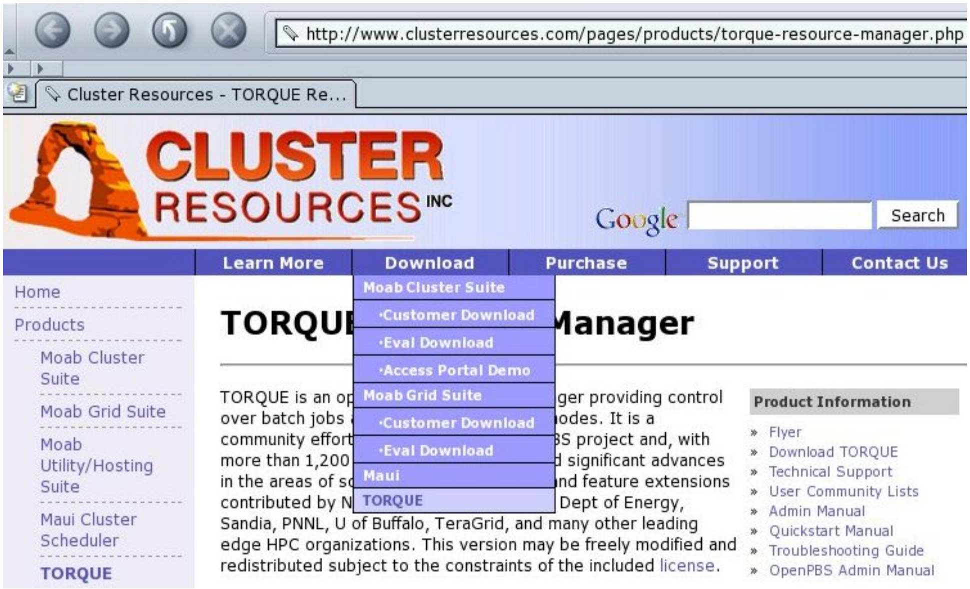
1 Obtaining and compiling TORQUE and Maui

Obtaining and compiling TORQUE

TORQUE Source Code

TORQUE is available from `www.clusterresources.com`



TORQU Manager

TORQUE is an op ger providing control
over batch jobs odes. It is a
community effort S project and, with
more than 1,200 d significant advances
in the areas of sc nd feature extensions
contributed by N Dept of Energy,
Sandia, PNNL, U of Buffalo, TeraGrid, and many other leading
edge HPC organizations. This version may be freely modified and
redistributed subject to the constraints of the included license.

Building TORQUE

- `configure -prefix=/whatever/you/likemakesumake install`
- not very clean, actually: quite a lot of important files go into `/var/spool` — including configuration files!

You can build only the server or MOM components, just tell `--disable-mom` or `--disable-server`

My favorite install uses a directory that is shared among the masternode and the computing nodes, so that I need to build only once.

TORQUE install uses 700 permission for `pbs_mom`, so you need to

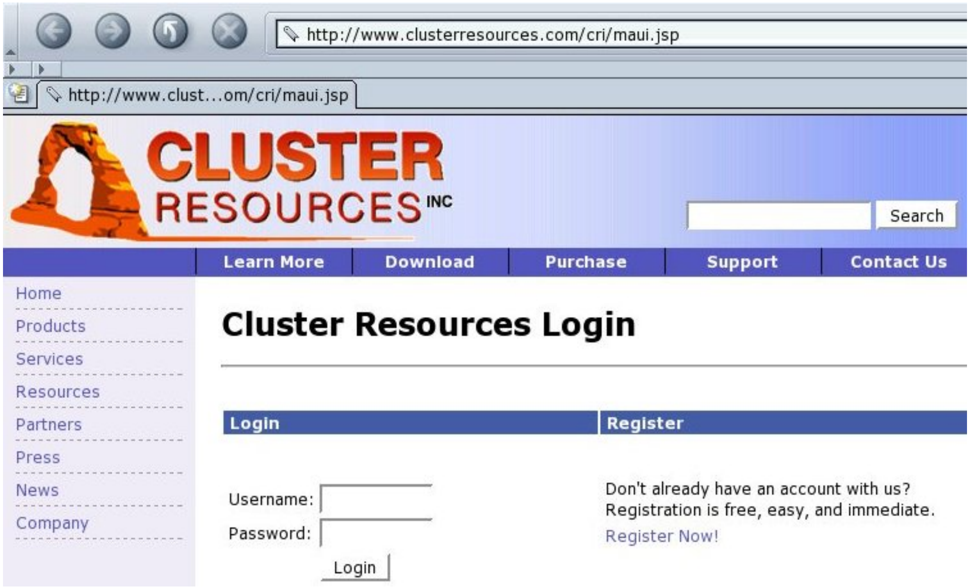
- share the install directory with `no_root_squash` **or**
- `chgrp nfsnobody pbs_mom ; chmod 710 pbs_mom`

Obtaining and compiling Maui

Maui Source Code

Maui too is available from `www.clusterresources.com`

You need to register to their site to download the code, and they *may* contact you later and ask what are you going to do with their software (and offer commercial support for it)



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Building Maui

- same «`configure; make; make install`»
- *but* there are a few issues with paths and options
  - if you are linking against `libpcre` (recommended) you need to edit `include/Makefile.inc.pcre.in` so that `-lpcreposix -lpcre` are passed as two separate options (remove quotes)
  - if `libpcre` is installed anywhere but `/usr/local` you *may* need to pass some `CFLAGS=-L...`
  - if your `prefix` is anything but `/usr/local/maui` you need to set `--with-spooldir` to have a consistent installation

2 Configuration

TORQUE Configuration

TORQUE Common Configuration Files

- `pbs_environment` contains the environment variables for TORQUE; any minimal set will do e.g.

```
PATH=/bin:/usr/bin
LANG=en_US
```

- `server_name` contains the «official» name of the machine where `pbs_server` runs (this is usually your master node) The server name *must* be identical to the FQDN e.g.

```
cerbero.hpc.sissa.it
```

Both these files reside in the spool directory (`/var/spool/torque`)

TORQUE `pbs_server` configuration

`server_priv/nodes` contains the list of available computing nodes and a list of attributes for each node.

node name	*# of CPUs*	*«features»* *(list of arbitrary strings,* *can be used later to select a node type)*

```
node01    np=2    opteron myri
node02    np=2    opteron myri
...
node51    np=4    opteron IB
node52    np=4    opteron IB
```

TORQUE `pbs_server` configuration

The bulk of `pbs_server` configuration is written in a (binary) database. You first need to create the empty database with

```
pbs_server -t create
```

This will *destroy any existing configuration*, create the empty database and start a `pbs_server`.

Configuration can then be edited using the `qmgr` tool. Configuration data are written to `server_priv/serverdb` as well as in various other files.

- if you are running postfix, you already have a `qmgr` somewhere in your system, so you may need to adjust some paths
- TORQUE `qmgr` needs a running `pbs_server` to actually write the configuration; this is because the configuration database is written by the server itself, and this in turn means that the server needs to have write permission on its own configuration

TORQUE `pbs_server` configuration

```
[root@borg]# qmgr
Qmgr:  create queue batch
Qmgr:  set queue batch queue_type = Execution
Qmgr:  set queue batch resources_max.walltime = 01:00:00
Qmgr:  set queue batch resources_default.nodes = 1
Qmgr:  set queue batch resources_default.walltime = 00:01:00
Qmgr:  set queue batch enabled = True
Qmgr:  set queue batch started = True
Qmgr:  set server managers = maui@borg.cluster
Qmgr:  set server managers += root@borg.cluster
Qmgr:  set server operators = maui@borg.cluster
Qmgr:  set server operators += root@borg.cluster
```

`pbs_mom` configuration

`pbs_mom` configuration can be fairly minimal, the only thing the Mom needs to know is the hostname where `pbs_server` is running on.

Useful additions include log configuration, how to handle user file copy and which filesystem to monitor for available space.

`mom_priv/config`:

```
$clienthost  master.hpc
$logevent    0x7f              size[fs=/local_scratch]
$usecp       *:/home /home
```

Maui Configuration

Maui Configuration

- simpler approach: a single configuration file (*`maui.cfg`*)
- Maui needs to know what RM to connect to and how

```
SERVERHOST           borg.cluster
RMCFG[BORG.CLUSTER]  TYPE=PBS
RMPOLLINTERVAL       00:00:30
SERVERPORT           42559
SERVERMODE           NORMAL
ADMIN1               root
```

`SERVERHOST` is the same we defined for TORQUE.

User(s) listed as `ADMIN1` have full control over Maui. The first user in the list must be used to run Maui itself; if you want to run Maui as a non-privileged user, put this username here. The user Maui is running as needs to be able to control `pbs_server`.

Maui Configuration

Job priority is recomputed at each scheduler iteration, according to site-defined parameters. If no parameters are set only queue time is taken into account, i.e. the scheduling is strictly FIFO.

Priority components include:

- ***Queue Time***: how long the job has been *idle* in the queue
- ***Credentials***: a static priority can be assigned on a user, group, queue basis
- ***Fair Share***: historical usage data
- ***Resources*** requested for the job

Maui Configuration

```
QUEUETIMEWEIGHT   1
XFACTORWEIGHT     10
CLASSCFG[batch]   PRIORITY=1
CLASSCFG[fast]    PRIORITY=1000
GROUPCFG[guests]  PRIORITY=1
GROUPCFG[users]   PRIORITY=1000
GROUPCFG[devel]   PRIORITY=10000
USERCFG[DEFAULT]  PRIORITY=2000
USERCFG[luser1]   PRIORITY=0
```

- a high `QUEUETIMEWEIGHT` makes the scheduling «more FIFO»
- $XFactor = \frac{QueueTime+WallClockLimit}{WallClockLimit}$ so a high `XFACTORWEIGHT` favors «short» jobs: this usually makes users happy in the short term, but can degrade overall cluster performance

Maui Configuration

The FS priority component must be explicitly enabled by setting its weight to a non-sero value.

```
FSINTERVAL      86400   duration of each FS window
FSDEPTH         30      number of FS windows
FSDECAY         0.90    decay factor applied to older FS windows
FSWEIGHT        1
FSGROUPWEIGHT   240
FSUSERWEIGHT    10
```

Maui Configuration

Usage targets can be set on a per-user, per-group and per-queue basis.

```
USERCFG[DEFAULT]  FSTARGET=1
GROUPCFG[users]   FSTARGET=30
GROUPCFG[devel]   FSTARGET=40
```

You can set also FS floors or caps so that priority is affected only when usage drops below the floor or goes above the cap:

```
GROUPCFG[guests]  FSTARGET=5-   give a negative priority component if usage
                                is above 5%
USERCFG[master]   FSTARGET=20+  give a priority boost if usage is below 20%
```

Prologue and Epilogue

Prologue & Epilogue scripts

pbs_mom looks for scripts in its configuration directory mom_priv. If found, the *prologue* script is executed just before job start and the *epilogue* script at job termination.

The prologue script performs any initialization that is requered on the node for the job to run, while the epilogue undoes the modifications.

/etc/security/access.conf

before prologue

```
-:ALL EXCEPT root:ALL
```

disallows login to everybody except root, from anywhere

⟶

after prologue

```
-:ALL EXCEPT root someuser:ALL
```

now allows someuser *to login*

3 Diagnostics & Troubleshooting

TORQUE Diagnostics

momctl

Query and control remote pbs_mom:

```
# momctl -d3 -h i602
Host: i602/i602.hpc Server: master.hpc Version: 1.2.0p6
  HomeDirectory:             /var/spool/PBS/mom_priv
  MOM active:                6907718 seconds
  Last Msg From Server:      213582 seconds (DeleteJob)
  Last Msg To Server:        1 seconds
  Server Update Interval:    45 seconds
  Init Msgs Received:        10 hellos/2 cluster-addrs
  Init Msgs Sent:            190 hellos
  LOGLEVEL:                  0 (use SIGUSR1/SIGUSR2 to adjust)
  Communication Model:       RPP
  TCP Timeout:               20 seconds
  Prolog Alarm Time:         300 seconds
  Alarm Time:                0 of 10 seconds
  Trusted Client List:       ...
  JobList:                   NONE
diagnostics complete
```

Maui Diagnostics

checknode

Check who is doing what on a node and show node capabilities

```
# checknode a034
checking node a034
State:  Busy (in current state for 1:13:38:12)
Configured Resources:  PROCS: 2 MEM: 3949M SWAP: 7242M DISK: 59G
Utilized Resources:  PROCS: 2 DISK: 10G
Dedicated Resources:  PROCS: 2
Opsys:  DEFAULT Arch:  [NONE]
Speed:  1.00 Load:  2.000 (ProcSpeed:  2600)
Network:  [DEFAULT]
Features:  [myri][opteron][opteron-sc]...
Attributes:  [Batch]
Classes:  [smp2 2:2][smp4 2:2][mpi4 0:2][mpi8 2:2]...
Total Time:  25:14:33:36 Active:  25:04:53:26 (98.43%)
Reservations:
Job '30069'(x2) -1:13:38:44 -> 2:10:20:16 (3:23:59:00)

JobList:  30069
```