



Shark Cluster Overview

51 Execution Nodes

1 Head Node (shark)

1 Graphical login node (rivershark)

800 Cores = slots

714 TB Storage RAW



```

';;
      ,0.;
    .''..          ;oO0o.           ;wC
0MMMMMMMWKxc.     'lOWMMNc         KMo
OMMMMMMMMMMMMMW0d:.;xWMMMMWL       cMMN
 lWMMMMMMMMMMMMMMMMMMMMMMMMM'        ,WMMMk;
.xWMMMMMMMMMMMMMMMMMMMMMMW          ;WMWWW0c.
.oNNMMMMMMMMMMMMMMMMMMmo            ,kMMWWL'...;cdxo:'
cxMMMMMMMMMMMMMMMMMO;.                .;xNMWWWX
 cMMMMMMMMMMMMMMMMMNoo;'....';lkNMMWWx. .;l
 cMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMNo.
 dMMMMMMWXK00XWMMMMMMMMMMMMMMMMMMwk,
 xMMMMk'          .,cdOKNMMMMMMMMMXd,
 dMMN'              .....k
.wN.
;;

Welcome to the Shark cluster @ the research network
This cluster is still under development.
Please report problems to M.P.Villierius.
```



Introduction

What is a cluster?

- A cluster is a group of computers connected with a tcp/ip-network.
 - The group can work as one large computer or as single computers called nodes.
 - The cluster is controlled by a resource manager Open Grid Scheduler

There are different type of nodes

- Head node
 - Uses a resource manager to manage all the resources
- Compute node
 - A single blade server
- Login node
 - `Shark.researchlumc.nl` / `rivershark.researchlumc.nl`
- Storage node
 - Isilon storage



Open Grid Scheduler

- OGS is a scheduler which divides the available resources(CPU,mem,etc) into queues
- OGS places the compute tasks (jobs) in a large list.
- OGS searches the right queue (all.q) for the requested resources in a job and starts that job.
- When the resources are full, the jobs are placed in a waiting list
- Jobs with a higher priority are placed higher in the list
- The priority is based on the priority resource and the fair-share policy



How to connect to Shark from LUMC

- You need to use your RESEARCHLUMC username and password to connect to the Shark cluster
- Linux / MAC use SSH
 - Command in terminal : `ssh researchlumcusername@145.88.65.151`
- Windows
 - use putty or mobaxterm
 - host : `shark.researchlumc.nl`
 - port : 22
- Login from outside the LUMC
 - Use the SSH jump server : `ip = 145.88.35.10`

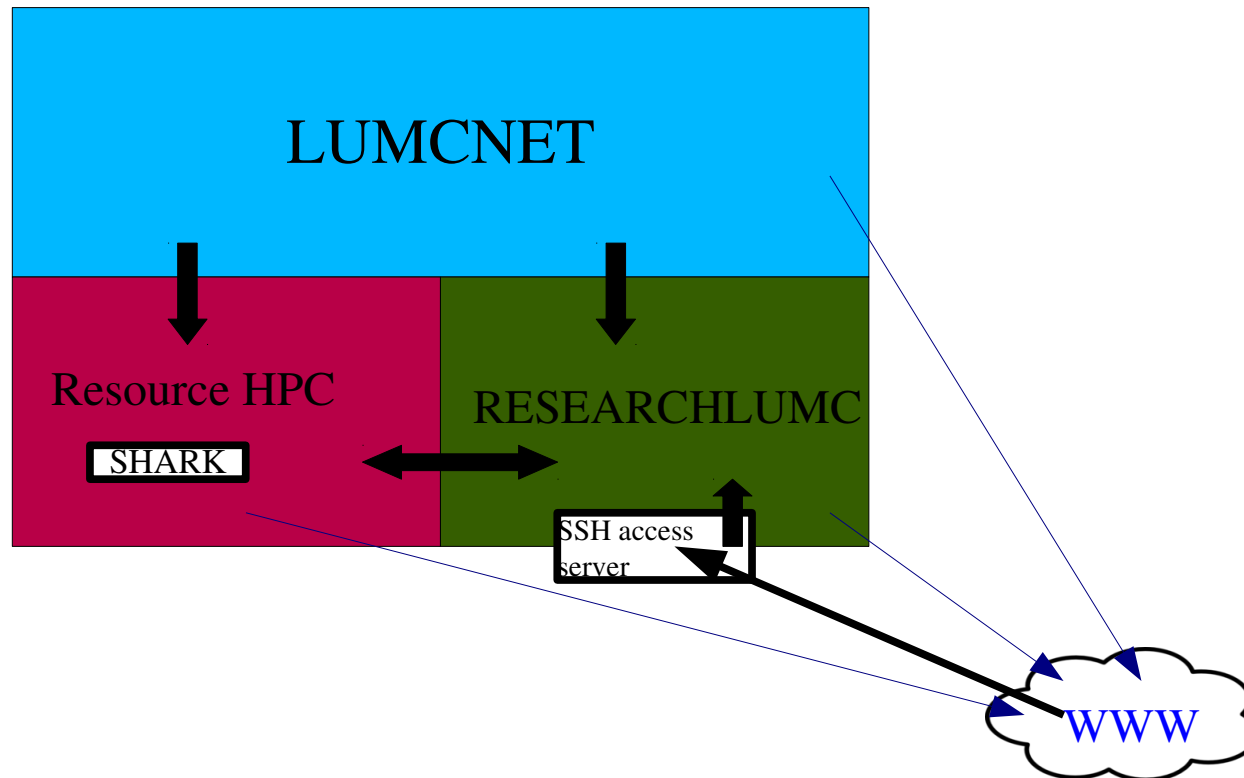


SSH schema

- SSH Default SSH port : 22
- SFTP
- SCP
- SSHFS

SSH server properties

- 3 times wrong user name / session : ip banned
- 3 times wrong password / session : ip banned





Where can I place my data?

Directory	Description	Size
/exports	Mount point for HPC Isilon storage	714TB
/exports/archive	Long Term Storage	~1P
/home/	Home dir, can hold: scripts, R library, compiled code	2TB
/bam-export	Everyone can save BAM files here that can be reached from the UCSC genome browser.External address : https://barmsijs.lumc.nl/.....	2TB

Location of important directories

- **/usr/local** *Where programs are located*
- **/usr/local/Genomes** *Where the reference genomes are located*



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What is your responsibility

- Describe what resources are necessary to ensure success for your jobs (**memory, run time**, disk space, **number of cores**)
- Not to overload the systems resources, CPU, mem, disk space
- Kill the job if the system is getting overloaded (qdel)
- Keep track of jobs when you are not sure what resources the job uses

Important Note :
qdel "JOB_ID" to kill a job
qdel -u "your username" to kill all your jobs



Interactive use of SGE

```
username@shark:~$ qlogin
```

```
Your job 822125 ("QLOGIN") has been submitted
```

```
waiting for interactive job to be scheduled ...
```

```
Your interactive job 822125 has been successfully scheduled.
```

```
Establishing /usr/local/Scripts/qlogin_wrapper session to host angelshark.researchlumc.nl ...
```

```
username@angelshark:~$ qstat
```

Job-ID	prior	name	user	state	submit/start at	queue	slots	ja-task-ID
822125	0.50075	QLOGIN	username	r	06/04/2014 13:17:25	qlogin.q@angelshark.researchlumc.nl	1	

```
username@shark:~$ qlogin -pe BWA 4
```

```
Your job 110997 ("QLOGIN") has been submitted
```

```
waiting for interactive job to be scheduled ...
```

```
Your interactive job 110997 has been successfully scheduled.
```

```
Establishing built in session to host angelshark.researchlumc.nl ...
```

```
vill@angelshark:~$
```

```
username@angelshark:~$ qstat
```

job-ID	prior	name	user	state	submit/start at	queue	slots	ja-task-ID
110997	0.53227	QLOGIN	vill	r	08/03/2011 03:13:59	qlogin.q@angelshark.researchlumc.nl	4	

Important Note : default memory of every job is set to
3GB / slot



Qsub your job

Only a script can be submitted with qsub !!!!!!!

Syntax qsub command:

qsub [options] [scriptfile | -- [script args]]

Binary files can not be submitted directly to SGE.

Example submit "date" command to OGS (with script):

```
#!/bin/bash
```

```
/bin/date
```

Submit this script with:

```
$ qsub sge-date
```

SGE will then run the program, and place two files in your home directory:

```
sge-date.e    sge-date.o
```

The most common options:

-N [name]	-- The name of the job
-l h_rt=hr:min:sec	-- Maximum walltime for this job
-l h_vmem	-- Maximum memory your job can use
-pe [type] [num]	-- Request [num] amount of [type] nodes.
-cwd	-- Place the output files (.e,.o) in the current working directory. The default is to place them in the users home directory.

Important Note : default memory of every job is set to 3GB / slot
-l h_vmem=3G



Qsub your job

Qsub options can be placed inside your script.

```
vill@shark:/home/vill/shark/trunk# cat run_my_first_job.sh
```

```
#!/bin/bash
```

```
#$ -S /bin/bash
```

```
#$ -q all.q <= use with care
```

```
#$ -N my_first_job
```

```
#$ -pe BWA 4 <==== the number 4 is only if you need 4 CPU's
```

```
#$ -l h_vmem=4g <== maximum memory that can be used.
```

```
#$ -cwd
```

```
#$ -j Y
```

```
#$ -V
```

```
#$ -m be
```

```
#$ -M email@address.lumc
```

```
echo Start time : `date`
```

```
/bin/hostname
```

```
echo End time : `date`
```

```
username@shark:~/shark/trunk$ qsub run_my_first_job.sh
```

Your **job 220282** ("my_first_job") has been submitted

```
username@shark:~/shark/trunk$ qstat
```

job-ID	prior	name	user	state	submit/start at	queue	slots	ja-task-ID
220282	0.60500	my_first_j	username	r	09/07/2011 09:26:55	all.q@kitefinshark.cluster.loc	4	

Important Note : default memory of every job is set to 3GB
-l h_vmem=4G



username@shark:~/shark/trunk\$ **qacct -j 220282**

```
=====
qname      all.q
hostname   kitefinshark.cluster.loc
group      NexGenSeq
owner      vill
project     NONE
department defaultdepartment
jobname     my_first_job
jobnumber   220282
taskid      undefined
account     sge
priority    20
qsub_time  Wed Sep  7 09:26:53 2011
start_time Wed Sep  7 09:26:54 2011
end_time   Wed Sep  7 09:27:15 2011
granted_pe  BWA
slots       4
failed      0
exit_status 0
ru_wallclock 21
ru_etime    0.040
ru_stime    0.010
ru_maxrss   1500
ru_ixrss    0
ru_ismrss   0
ru_idrss    0
ru_isrss    0
ru_minflt   2332
ru_majflt   0
ru_nswap    0
ru_inblock  16
ru_oublock  192
ru_msgsnd   0
ru_msgrcv   0
ru_nsignals 0
ru_nvcsw    148
ru_nivcsw    5
cpu        0.050
mem        0.000
io         0.000
iow        0.000
maxvmem    30.523M  <= note the maximum memory that has been used
arid        undefined
```

Important Note : default memory of every job is set to 3GB

Job has been submitted with 4GB times 4 slots = 16GB can be submitted with 15MB

-l h_vmem=15m



What can I run where ?

- HEAD Node
 - Small non memory/cpu intensive jobs
 - vi, vim, nano
 - scp, sftp
 - Compile small programs
- Graphical Login Node
 - Firefox, fslview, gedit, etc
- Execution Nodes
 - Large jobs
 - R(run only on here!)
 - Pipelines
 - Matlab

Do not run Qlogin and go to lunch while this slot is doing nothing.



Environment Modules

- The Environment Modules package provides for the dynamic modification of a user's environment via modulefiles.

```
# module list
```

```
Currently Loaded Modulefiles:
```

```
1) OpenGridScheduler 2) History 3) R/3.0.2
```

```
#module avail
```

```
----- /usr/local/Modules/versions -----
```

```
3.2.10
```

```
----- /usr/local/Modules/3.2.10/modulefiles-----
```

dot	java/Oracle-JRE-1.7	module-info	OpenGridScheduler	R/2.15.3	smrtanalysis
History	java/Oracle-JRE-1.8	modules	python/python-3.4.1	R/3.0.2	use.own
java/openjdk-7	module-git	null	qiime	R/3.1.1	

```
#module load R/3.0.2
```

```
#module unload R/3.0.2
```

```
#module switch R/3.1.1
```



Summary

- **qsub** submit a job to the batch scheduler
- **qlogin** submit an interactive login session to Grid Engine
- **qstat** examine the job queue
- **qdel** delete a job from the queue
- **qacct** report and account for Grid Engine usage
- **unique-user-slots**
- /home Home dir do not store DATA here
- /data/... for storage of your data
- /usr/local/Genomes/ dir where ref. Files are located
- /bam-export dir for temp. bam files and share files.
- <http://barmsijs.lumc.nl/>