

Technical report of the setup procedure of a Ubuntu Server computer cluster

Alexandre Manhães Savio

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1 Master Node - Giclus1

1.1 Operating system and network configuration

- Install Ubuntu Server 10.04.1 amd64
- Partitions
 - /dev/sda1: 20GB on /
 - /dev/sda2: 20GB on /usr/local
 - /dev/sda3: 130GB on /home
 - /dev/sda5: 280GB on /opt
 - /dev/sda6: 20GB of swap area
- Add gic group:
 - `sudo addgroup gic`
 - `sudo addgroup alexandre gic`
- Add more users:
 - `sudo adduser <user_name> --ingroup gic --disabled-password`
 - `ssh-keygen -b 4096 -t rsa -C user_name`
 - `chown -R user_name:root /home/user_name/.ssh`
 - `chmod 700 /home/user_name/.ssh`
 - `chmod 400 /home/user_name/.ssh/authorized_keys`
- Edit /etc/network/interfaces

```
auto lo
iface lo inet loopback

auto eth1
iface eth1 inet loopback
    address 192.168.1.81
    netmask 255.255.255.0
    gateway 192.168.1.1

auto eth0
iface eth0 inet dhcp
```

- Edit `/etc/resolv.conf`

```
nameserver 10.20.13.6
nameserver 10.10.13.6
nameserver 10.30.13.6
```

- Edit `/etc/hosts`

```
127.0.0.1 localhost
192.168.1.81 giclus1
192.168.1.82 giclus2
192.168.1.83 giclus3
192.168.1.84 giclus4
```

- Edit `/etc/hosts.allow`

```
portmap ypserv ypbind sge_qmaster sge_execd : \
192.168.1.81 192.168.1.82 192.168.1.83 192.168.1.84
```

- `sudo /etc/init.d/networking restart`

- Install packages:

- Add "partner" repository, editing `/etc/apt/sources.list`
- `sudo apt-get update`
- `sudo apt-get install ssh molly-guard openssh-blacklist openssh-blacklist-extra ssh-askpass binutils unzip sun-java6-jre`
- Edit `/etc/ssh/sshd_conf`: disable root access and password auth

1.2 NIS Server

- `sudo apt-get install portmap nis`
- NIS domain name: `giclus`

- For more details: <https://help.ubuntu.com/community/SettingUpNISHowTo>
- Edit `/etc/default/portmap` and comment out the `ARGS="-i 127.0.0.1"` line
- Edit `/etc/default/nis` and set the `NISSERVER` line to `NISSERVER=master`
- Edit `/etc/yp.conf`: `domain giclus server giclus1`
- Edit `/etc/ypserv.securenets`

```
host 192.168.1.81
host 192.168.1.82
host 192.168.1.83
host 192.168.1.84
```
- Build the DB for the first time, run: `sudo /usr/lib/yp/ypinit -m`
- Read the web page (<https://help.ubuntu.com/community/SettingUpNISHowTo>) for more information on security and the client config (see next section)
- Restart:
 - `sudo /etc/init.d/portmap restart`
 - `sudo /etc/init.d/nis restart`

1.3 NFS Kernel Server

- <https://help.ubuntu.com/community/SettingUpNFHowTo>
- `sudo apt-get install nfs-watch nfs-kernel-server`
- `sudo mkdir /sge`
- Edit `/etc/exports` and add the shares:


```
/home giclus1(rw, sync, no_subtree_check) /
giclus2(rw, sync, no_subtree_check) /
giclus3(rw, sync, no_subtree_check) /
giclus4(rw, sync, no_subtree_check)

/usr/local giclus1(rw, sync, no_subtree_check) /
giclus2(rw, sync, no_subtree_check) /
giclus3(rw, sync, no_subtree_check) /
giclus4(rw, sync, no_subtree_check)

/opt giclus1(rw, sync, no_subtree_check) /
giclus2(rw, sync, no_subtree_check) /
giclus3(rw, sync, no_subtree_check) /
giclus4(rw, sync, no_subtree_check)
```

```
/sge giclus1(rw, sync, no_subtree_check) /
giclus2(rw, sync, no_subtree_check) /
giclus3(rw, sync, no_subtree_check) /
giclus4(rw, sync, no_subtree_check)
```

- `sudo exportfs -ra`

1.4 MSMTP:

- Create a Gmail account for monitoring. I do this because I don't want my gmail password floating around in plaintext on various machines.

- Install the `ca-certificates` package

```
sudo aptitude install ca-certificates
sudo update-ca-certificates
```

- `sudo apt-get install msmtplib`

- Edit `/etc/msmtplib`

```
account gmail
host smtp.gmail.com
from giclus1@gmail.com
auth on
tls on
tls_trust_file /etc/ssl/certs/ca-certificates.crt
user giclus1@gmail.com
password *****
port 587

account default : gmail
```

- Create a sendmail simlink:

```
- sudo ln -s /usr/bin/msmtplib /usr/sbin/sendmail
```

- -Run a test

```
- echo "This is a an awesome test email" | msmtplib youremail@domain.com
```

- - If you want `mdadm` to mail you when something goes wrong

```
- Edit /etc/mdadm/mdadm.conf: MAILADDR giclus1@gmail.com
```

- And then run a `mdadm` test by running

```
- sudo mdadm --monitor --scan --test --oneshot
```

1.5 Share internet connection with the others in the cluster:

1.5.1 UFW Version

- Enable UFW

```
sudo ufw enable
sudo ufw allow 22/tcp
sudo ufw allow 22/udp
sudo ufw allow in on eth1
```

- Edit file `/etc/ufw/before.rules`:

```
# nat Table rules
*nat :POSTROUTING ACCEPT [0:0]
# .
-A POSTROUTING -s 192.168.1.0/24 -o eth1 -j MASQUERADE
COMMIT
```

- Edit `/etc/default/ufw`

- Change `DEFAULT_FORWARD_POLICY` to “ACCEPT”
- Uncomment:

```
* net/ipv4/ip_forward=1
* net/ipv6/conf/default/forwarding=1
```

- Restart ufw:

- `sudo ufw disable`
- `sudo ufw enable`

1.5.2 IPTABLES Version

- `sudo iptables -A FORWARD -i eth0 -o eth1 -s 192.168.1.0/24 -m conntrack --ctstate NEW -j ACCEPT`
- `sudo iptables -A FORWARD -m conntrack --ctstate ESTABLISHED,RELATED -j ACCEPT`
- `sudo iptables -A POSTROUTING -t nat -j MASQUERADE`
- `sudo iptables-save | sudo tee /etc/iptables.sav`
- Add to `/etc/rc.local`
 - `iptables-restore < /etc/iptables.sav`

- Add to `/etc/sysctl.conf`
 - `net.ipv4.conf.default.forwarding=1`
 - `net.ipv4.conf.all.forwarding=1`
- `sudo sh -c "echo 1 > /proc/sys/net/ipv4/ip_forward"`

1.6 Sun Grid Engine Master

- <http://biowiki.org/HowToAdministerSunGridEngine>
- <https://www.fmrib.ox.ac.uk/phpwiki/index.php/FslSge>
- `sudo apt-get install libmotif3 libxpm4`
- Download SGE from: <http://www.oracle.com>
- Install SGE (check this):

```
mkdir /opt/soft/sge
mv ge-6.1u6-* ../../soft/sge
cd ../../soft/sge
tar xvzf ge-6.1u6-common.tar.gz
tar xvzf ge-6.1u6-arco.tar.gz
tar xvzf ge-6.1u6-bin-lx24-amd64.tar.gz
cd ..\ sudo cp -rdvfa sge /
cd /sge
scp -rdv giclus1:/sge/* .
sudo ./inst_sge -m -x
```

- Now go through the interactive install process
- Add to `/etc/bash.bashrc`

```
#SGE settings export
SGE_ROOT=/sge
export SGE_CELL=default
if [ -e $SGE_ROOT/$SGE_CELL ]
then
. $SGE_ROOT/$SGE_CELL/common/settings.sh
fi
```

- **ERROR** “[: 359: 11: unexpected operator”

- On Ubuntu 10.04 LTS libc version detection fails in util/arch. The reason is that now (around line 244) `strings libc.so.6` returns GNU C Library (Ubuntu EGLIBC 2.11.1-0ubuntu7) stable release version 2.11.1, by Roland McGrath et al. where the version number appears twice. The subsequent tests get a string like "11\n11" instead of just "11" and the shell complains that the syntax of the if conditions is wrong. I fixed it by adding `uniq` to this line to the file `/sge/util/arch`:

```
libc_version='echo $libc_string | tr ' ,' '\n' | grep "2\." /
| cut -f 2 -d "." | uniq'
```

- **ERROR sgemaster and sgeexecd won't start on boot**

```
cd /etc/init.d/
sudo update-rc.d sgeexecd.giclus defaults
sudo update-rc.d sgemaster.giclus defaults
```

- Add user group for execution sgeusers:

- `sudo addgroup sgeusers`
- Add the users who are going to use SGE to this group
- Change owner group of `$SGE_ROOT` to `sgeusers`

- Configure `@allhosts` SGE execution group:

- Show group: `qconf -shgrp @allhosts`
 - Edit group: `qconf -shgrp @allhosts`
- ```
group_name @allhosts
hostlist giclus1 giclus2 giclus3 giclus4
```

## 2 The other nodes: GICLUS{2-3-4}

### 2.1 Operating system and network configuration

- Install Ubuntu Server 10.04.1 amd64
- Partitions
  - `/dev/sda1`: 30GB on `/`
  - `/dev/sda2`: 450GB on `/local_opt`
  - `/dev/sda3`: 20GB of swap area

- Add gic group:
  - sudo addgroup gic
  - sudo addgroup alexandre gic
- Add more users:
  - sudo adduser <user\_name> --ingroup gic --disabled-password
  - ssh-keygen -b 4096 -t rsa -C user\_name
  - chown -R user\_name:root /home/user\_name/.ssh
  - chmod 700 /home/user\_name/.ssh
  - chmod 400 /home/user\_name/.ssh/authorized\_keys
- Edit /etc/network/interfaces
 

```

auto lo
iface lo inet loopback

auto eth1
iface eth1 inet loopback
 address 192.168.1.8{2,3,4}
 netmask 255.255.255.0
 gateway 192.168.1.81

```
- Edit /etc/resolv.conf
 

```

nameserver 10.20.13.6
nameserver 10.10.13.6
nameserver 10.30.13.6

```
- Edit /etc/hosts
 

```

127.0.0.1 localhost

192.168.1.81 giclus1
192.168.1.82 giclus2
192.168.1.83 giclus3
192.168.1.84 giclus4

```
- sudo /etc/init.d/networking restart
- Install packages:
  - Add "partner" repository, editing /etc/apt/sources.list
  - sudo apt-get update
  - sudo apt-get upgrade



- `sudo apt-get install ssh molly-guard openssh-blacklist openssh-blacklist-extra ssh-askpass binutils unzip sun-java6-jre`
- Edit `/etc/ssh/sshd_conf`: disable root access and password authentication

## 2.2 NIS Client

- <https://help.ubuntu.com/community/SettingUpNISHowTo>
- `sudo apt-get install nis`
- NIS domain name: `giclus`
- Edit `/etc/hosts.allow`: `portmap : 192.168.1.81`
- Add to `/etc/passwd` (+6x':')
- +:::::::
- Add to `/etc/group` (+3x':')
- +:::
- Add to `/etc/shadow` (+8x':')
- +::::::::
- Edit `/etc/yp.conf` and add the line: `ypserver giclus1`
- `/etc/init.d/nis restart`
- `/etc/init.d/ssh restart`
- or `sudo reboot`

## 2.3 NFS Client

- `sudo apt-get install nfs-common`
  - `sudo mkdir /sge`
  - Add to `/etc/fstab`
- ```
#NFS Cluster mount
giclus1:/home /home nfs rsize=8192,wsiz=8192,timeo=14,intr,rw
giclus1:/opt /opt nfs rsize=8192,wsiz=8192,timeo=14,intr,rw
giclus1:/usr/local /usr/local nfs rsize=8192,wsiz=8192,timeo=14,intr,rw
giclus1:/sge /sge nfs rsize=8192,wsiz=8192,timeo=14,intr,rw
```

2.4 Sun Grid Engine Exec Daemon

- <http://biowiki.org/HowToAdministerSunGridEngine>
- <https://www.fmrib.ox.ac.uk/phpwiki/index.php/FslSge>
- `sudo apt-get install libmotif3 libxpm4`
- `sudo mount /sge`
- Download SGE from: <http://www.oracle.com>
- Install SGE (check this):

```
mkdir /opt/soft/sge
mv ge-6.1u6-* ../../soft/sge
cd ../../soft/sge
tar xvzf ge-6.1u6-common.tar.gz
tar xvzf ge-6.1u6-arco.tar.gz
tar xvzf ge-6.1u6-bin-lx24-amd64.tar.gz
cd ..\ sudo cp -rdvfa sge /
cd /sge
scp -rdv giclus1:/sge/* .
sudo ./install_execd
```

- Now go through the interactive install process
- Add to `/etc/bash.bashrc`

```
#SGE settings export
SGE_ROOT=/sge
export SGE_CELL=default
if [ -e $SGE_ROOT/$SGE_CELL ]
then
    . $SGE_ROOT/$SGE_CELL/common/settings.sh
fi
```

- Diagnosis commands:

```
- ps -A | grep sge
- qping giclus1 6444 qmaster 1
```

- **ERROR** “[: 359: 11: unexpected operator”

– On Ubuntu 10.04 LTS libc version detection fails in `util/arch`. The reason is that now (around line 244) `strings libc.so.6` returns GNU C Library (Ubuntu EGLIBC 2.11.1-0ubuntu7) stable release version

2.11.1, by Roland McGrath et al. where the version number appears twice. The subsequent tests get a string like "11\n11" instead of just "11" and the shell complains that the syntax of the if conditions is wrong. I fixed it by adding `uniq` to this line to the file `/sge/util/arch`:

```
libc_version='echo $libc_string | tr ' , ' '\n' | grep "2\." /
| cut -f 2 -d "." | uniq'
```

- **ERROR** `sgemaster` and `sgeexecd` won't start on boot

```
cd /etc/init.d/
sudo update-rc.d sgeexecd.giclus defaults
```

3 Execute in all nodes

3.1 Install NeuroDebian Repository (<http://neuro.debian.net/>)

- Installation:

```
wget -c http://neuro.debian.net/_static/neurodebian.lucid.de.sources.list
wget -c http://neuro.debian.net/_static/neuro.debian.net.asc
sudo apt-key add neuro.debian.net.asc
sudo cp neurodebian.lucid.de.sources.list /etc/apt/sources.list.d
sudo apt-get update
sudo apt-get upgrade
sudo apt-get install fsl fsl-atlases fsl-first-data nifti-bin
```

- Add to `/etc/bash.bashrc`:

```
- . /etc/fsl/fsl.sh
```

3.2 Other configuration details

- Local temporary work directory

```
- Add to /etc/environment
  * LOCAL_TEMP="/local"
  * (for giclus1) this has been set to "/opt/temp"
- sudo chown -R alexandre:gic /local
- sudo chmod -R 770 /local
```