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

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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 loiface lo inet loopbackauto eth1iface eth1 inet static
  address 192.168.1.81netmask 255.255.255.0gateway 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/SettingUpNFSHowTo

- `sudo apt-get install nfswatch 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_c
  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 msmtp`

- Edit `/etc/msmtprc`

```
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/msmtp /usr/sbin/sendmail`

- -Run a test

  – `echo "This is a an awesome test email" | msmtp 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 ap-
    pears twice. The subsequent tests get a string like `"11\n11"` instead
    of just `"11"` and the shell complains that the syntax of the if con-
    ditions 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
    ```

- **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 loiface lo inet loopbackauto eth1iface eth1 inet static
  address 192.168.1.8{2,3,4} netmask 255.255.255.0 gateway
  192.168.1.81

- Edit /etc/resolv.conf

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```
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,wsize=8192,timeo=14,intr,rw
giclus1:/opt /opt nfs rsize=8192,wsize=8192,timeo=14,intr,rw
giclus1:/usr/local /usr/local nfs rsize=8192,wsize=8192,timeo=14,intr,rw
giclus1:/sge /sge nfs rsize=8192,wsize=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`

- **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`