

PEMEROSAN PARALEL
“Bubble Sort dan MPI”



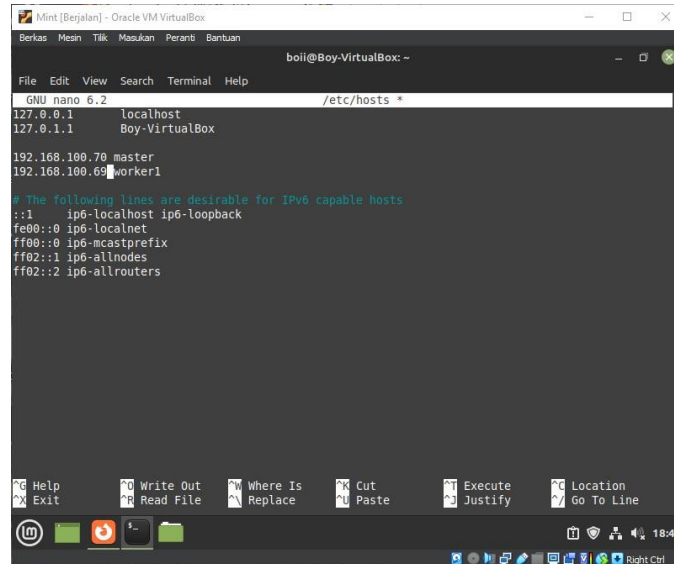
Disusun :

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PROGRAM STUDI SISTEM KOMPUTER
FAKULTAS ILMU KOMPUTER
UNIVERSITAS SRIWIJAYA
PALEMBANG
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1. Konfigurasi file '/etc/hosts' pada Server dan Client

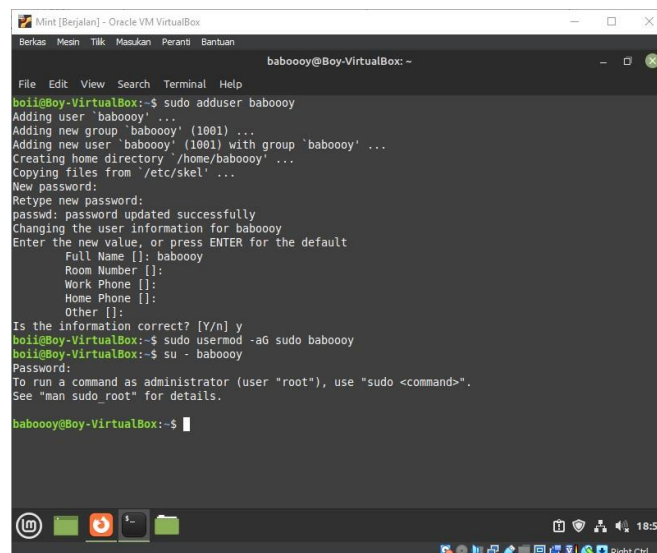
Pertama konfigurasi file '/etc/hosts' di Server dan Client yang mana dalam konfigurasi ini dipastikan dulu Server dan Client saling dikenali dengan benar melalui nama host dan alamat IP yang sesuai dan berkas akan digunakan untuk menetapkan korespondensi antara alamat IP dan nama host.



```
Mint [Bejalan] - Oracle VM VirtualBox
berkas Mesin Titik Masukan Peranti Bantuan
boii@Boy-VirtualBox: ~
File Edit View Search Terminal Help
GNU nano 6.2 /etc/hosts
127.0.0.1 localhost
127.0.1.1 Boy-VirtualBox
192.168.100.70 master
192.168.100.69 worker1
# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
Help Exit Write Out Where Is Cut Execute Location
Read File Replace Paste Justify Go To Line
18:47
```

2. Pembuatan User dan Pemberian Akses ke Grup Sudo

Selanjutnya langkah-langkah pembuatan user baru dan penambahan ke grup 'sudo'. Perintah 'sudo usermod -aG sudo baboooy' digunakan untuk menambahkan user ke grup sudo untuk memberikan akses administratif.



```
Mint [Bejalan] - Oracle VM VirtualBox
berkas Mesin Titik Masukan Peranti Bantuan
baboooy@Boy-VirtualBox: ~
File Edit View Search Terminal Help
boii@Boy-VirtualBox:~$ sudo adduser baboooy
Adding user 'baboooy' ...
Adding new group 'baboooy' (1001) ...
Adding new user 'baboooy' (1001) with group 'baboooy' ...
Creating home directory /home/baboooy' ...
Copying files from /etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for baboooy
Enter the new value, or press ENTER for the default
Full Name []: baboooy
Room Number []:
Work Phone []:
Home Phone []:
Other []:
Is the information correct? [Y/n] y
boii@Boy-VirtualBox:~$ sudo usermod -aG sudo baboooy
boii@Boy-VirtualBox:~$ su - baboooy
Password:
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
baboooy@Boy-VirtualBox:~$
```

3. Konfigurasi Secure Shell (SSH)

Digambar ini menunjukkan konfigurasi secure shell (SSH). Proses ini mencakup pembuatan kunci SSH, konfigurasi file 'sshd_config', dan pertukaran kunci antara Server dan Client. Semua proses ini diperlukan agar Server dan Client dapat berkomunikasi dengan aman menggunakan protokol SSH.

```
Mint [Berjalan] - Oracle VM VirtualBox
baboooy@Boy-VirtualBox: ~/ssh

This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'master' (ED25519) to the list of known hosts.
baboooy@master's password:
"anda Telah Berhasil Login User"
baboooy@Boy-VirtualBox:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/baboooy/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/baboooy/.ssh/id_rsa
Your public key has been saved in /home/baboooy/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:Go4Gpv/m33urNIA9wLQ2YHsVMe8BEniXl1fwWtLgnFY baboooy@Boy-VirtualBox
The key's randomart image is:
+--[RSA 3072]-----+
|  oo*.+.. ..oE|
| ..+..+..+..+|
| o... ..o..+o|
| o + ..o+..|
| o + = So o|
| o . + =|
| . o o o|
| .. o ..|
| ..+.. +..|
+---[SHA256]-----+
baboooy@Boy-VirtualBox:~$ cd .ssh
baboooy@Boy-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh baboooy@master "mkdir .ssh; cat >> .ssh/authorized_keys"
```

4. Instalasi dan Konfigurasi Network File System (NFS)

Selanjutnya proses instalasi dan konfigurasi NFS yang memungkinkan berbagai sistem file antara Server dan Client. Melibatkan proses instalasi NFS , konfigurasi file 'etc/exports', dan melakukan reset layanan NFS.

```
Mint [Berjalan] - Oracle VM VirtualBox
baboooy@master: ~

baboooy@client's password:
mkdir: cannot create directory '.ssh': File exists
baboooy@master:~/.ssh$ cat id_rsa.pub | ssh baboooy@client "mkdir .ssh; cat >> .ssh/authorized_keys"
baboooy@client's password:
baboooy@master:~/.ssh$ cd
baboooy@master:~$ ls
cloud
baboooy@master:~$ sudo apt install nfs-kernel-server
[sudo] password for baboooy:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nfs-kernel-server is already the newest version (1:2.6.1-1ubuntu1.2).
The following packages were automatically installed and are no longer required:
liba52-0.7.4 libaribb24-0 libcdcb2 libdca0 libdvbpsi10 libebml5 libfaad2 libixml10 libkate1
libmad0 libmatroska7 libmpcdec6 libmpeg2-4 libopenmpt-modplug1 libprotobuf-lite23
libproxy-tools libqt5x11extras5 libresid-builder0c2a libSDL-image1.2 libSDL1.2debian
libsidplay2 libspatialaudio0 libssh2-1 libupnp13 libvlc-bin libvlc5 libvlccore9 libvncclient1
libxcb-composite0 vlc-bin vlc-data vlc-l10n vlc-plugin-access-extra vlc-plugin-base
vlc-plugin-notify vlc-plugin-qt vlc-plugin-samba vlc-plugin-skins2 vlc-plugin-video-output
vlc-plugin-video-splitter vlc-plugin-visualization
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
baboooy@master:~$ sudo nano /etc/exports
baboooy@master:~$ sudo nano /etc/exports
baboooy@master:~$ sudo exportfs -a
baboooy@master:~$ sudo systemctl restart nfs-kernel-server
baboooy@master:~$
```

```
Mint [Berjalan] - Oracle VM VirtualBox
Berkas Mesin Titik Masukan Peranti Bantuan

baboooy@Boy-VirtualBox: ~
File Edit View Search Terminal Help
Processing triggers for ufw (0.36.1-4ubuntu0.1) ...
baboooy@Boy-VirtualBox:~$ ssh baboooy@master
The authenticity of host 'master (192.168.100.70)' can't be established.
ED25519 key fingerprint is SHA256:v7eqb0BuqalJ3U82uAxVI4sBGk3E4do9WeWYTw3ZwNg.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'master' (ED25519) to the list of known hosts.
baboooy@master's password:
"anda telah berhasil login user"
baboooy@Boy-VirtualBox:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/baboooy/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/baboooy/.ssh/id_rsa
Your public key has been saved in /home/baboooy/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:Go4Gpv/m33urNIA9wLQ2YHsVMe8BEniXL1fwWtLGNFY baboooy@Boy-VirtualBox
The key's randomart image is:
+--[RSA 3072]--++
  oo*+*... ..oE
  ..+..+..+..+
  o... ..o..+o
  o + ..o+..
  o + = 5oo
  o + =
  . o o o
  .. o ..
  +o... ++..
```

5. Pengujian pada file Python

Selanjutnya melakukan pengujian pada file Python (py). Pengujian ini memiliki tujuan untuk memastikan apakah konfigurasi yang dilakukan sebelumnya berhasil atau tidak.

```
baboooy@master:~/cloud$ sudo nano test.py
[sudo] password for baboooy:
baboooy@master:~/cloud$
```

```
GNU nano 6.2 test.py
print("Hello World")
```

```
Mint [Berjalan] - Oracle VM VirtualBox
Berkas Mesin Titik Masukan Peranti Bantuan

baboooy@master: ~/cloud
File Edit View Search Terminal Help
processor cores if not provided)
2. The --host command line parameter, via a ":"N" suffix on the
hostname (N defaults to 1 if not provided)
3. Resource manager (e.g., SLURM, PBS/Torque, LSF, etc.)
4. If none of a hostfile, the --host command line parameter, or an
RM is present, Open MPI defaults to the number of processor cores

In all the above cases, if you want Open MPI to default to the number
of hardware threads instead of the number of processor cores, use the
--use-hwthread-cpus option.

Alternatively, you can use the --oversubscribe option to ignore the
number of available slots when deciding the number of processes to
launch.
-----
baboooy@master:~/cloud$ mpirun -np 2 -host master,client python3 test.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Hello World
Hello World
baboooy@master:~/cloud$ mpirun -np 1 -host master,client python3 test.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Hello World
baboooy@master:~/cloud$
```

6. Melakukan Komputasi Kode Bubble Sort dan Numerik

Terakhir proses komputasi menggunakan kode Bubble Sort dan menunjukkan operasi numerik. Ditahap ini, melakukan verifikasi bahwa lingkungan pemrosesan paralel dengan MPI sudah dikonfigurasi dengan baik dan hasil komputasi sesuai harapan.

```
babooy@client:~/cloud$ python3 bubbleshort.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
waktu dikerjakan 0.0002276897430419922
Sorted Data: [1, 2, 5, 5, 6, 9]
babooy@client:~/cloud$ mpirun -np 1 python3 bubbleshort.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
waktu dikerjakan 0.00020074844360351562
Sorted Data: [1, 2, 5, 5, 6, 9]
babooy@client:~/cloud$
```

```
babooy@master:~/cloud$ mpirun -np 1 python3 numerik.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Total hasil perhitungan: 55
waktu dikerjakan 0.0005698204040527344
babooy@master:~/cloud$ python3 numerik.py
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Total hasil perhitungan: 55
waktu dikerjakan 0.0005998611450195312
babooy@master:~/cloud$
```