

LAPORAN PRAKTIKUM ARSITEKTUR DAN ORGANISASI KOMPUTER



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**LAB. JARINGAN KOMPUTER DAN KOMUNIKASI DATA
JURUSAN SISTEM KOMPUTER
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MPI

MPI (Message Passing Interface) dalam konteks arsitektur sistem komputer adalah sebuah standar komunikasi yang digunakan untuk mengizinkan proses yang berjalan secara paralel untuk berkomunikasi satu sama lain. Pada dasarnya, MPI memungkinkan proses yang berjalan pada nodenode yang berbeda dalam sebuah sistem komputer paralel untuk saling bertukar data.

Dalam arsitektur komputer, terutama dalam lingkungan komputasi paralel atau distribusi, MPI digunakan sebagai antarmuka atau protokol komunikasi yang memungkinkan proses-proses yang berjalan secara paralel di beberapa node untuk berkoordinasi, bertukar informasi, dan melakukan tugas-tugas tertentu secara terkoordinasi.

MPI memberikan serangkaian fungsi atau operasi yang memungkinkan proses untuk mengirim dan menerima pesan satu sama lain, melakukan sinkronisasi, dan mengelola komunikasi antara proses-proses yang berjalan secara paralel dalam sistem yang terdiri dari beberapa node atau unit pemrosesan. Hal ini sangat penting dalam komputasi paralel untuk memastikan kolaborasi dan koordinasi yang efisien antara proses yang berjalan secara terpisah.

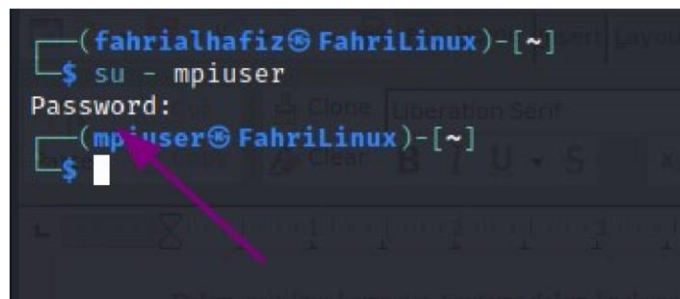
Untuk langkah-langkah nya pertama persiapan
4 device Ubuntu Dekstop untuk 1 menjadi master dengan 3 slave
MPI (Master dan Slave)
SSH (Master dan slave)
NFS (Master dan slave)
File Python (.py)

1.Membuat Master dan Slave

Buat User baru dengan nama mpiuser untuk master maupun slave untuk mempermudah melakukan Mpi nanti sudo adduser mpiuser

Lalu beri izin ke user baru dengan perintah sudo
usermod -aG sudo mpiuser

Lakukan untuk semua master dan slave , lalu setelah diizinkan masuk ke user yang baru di buat dengan
sudo - mpiuser



Jika sudah akan muncul tampilah seperti gambar di bawah ini

lakukan update di user baru dan install net-tools

```
sudo apt update && sudo apt upgrade  
sudo apt install net-tools vim
```

Jika sudah Cek pada masing masing Device , untuk di konfigurasikan menggunakan cd /etc/hosts

atur alamat ip dengan peran yang telah ditentukan

```
127.0.0.1    localhost  
127.0.1.1    habib-VirtualBox  
  
10.1.8.111   master  
10.1.8.224   slave1  
10.1.9.21    slave2  
10.1.9.199   slave3  
  
# 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
```

Pastikan untuk mengingat dengan baik siapa yang master dan slave 1 – 3

2. Mengatur SSH

Lakukan penginstalan pada master dan semua slave untuk openssh server

```
sudo apt install openssh-server
```

dilanjutkan dengan membuat key ssh hanya di master ssh-

```
keygen -t rsa
```

Masih di master gunakan perintah untuk men copy public key ke semua slave

```
cd .ssh
```

```
ssh mpiuser@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
```

Lakukan sampai slave ke 3 ssh [mpiuser@slave2](#) "mkdir .ssh; cat >>

```
.ssh/authorized_keys" ssh mpiuser@slave3 "mkdir .ssh; cat  
>> .ssh/authorized_keys"
```

```

mpiuser@habib-VirtualBox:~$ cd .ssh
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave1 (10.1.8.224)' can't be established.
ED25519 key fingerprint is SHA256:UydkBHUXzfe2L3vAFUx1yFUDrJTloy0xVF4zMdanU+c.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave1' (ED25519) to the list of known hosts.
mpiuser@slave1's password:
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave2 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave2 (10.1.9.21)' can't be established.
ED25519 key fingerprint is SHA256:mdzDsKI/vr1HiT3/skqpVe7ZJ9cNwX5SRPx4r6SxYxk.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave2' (ED25519) to the list of known hosts.
mpiuser@slave2's password:
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave3 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave3 (10.1.9.199)' can't be established.
ED25519 key fingerprint is SHA256:pjtG/2GUNTazfylvP77PiZQTmVt82YrxLIUKXO/YFXI.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave3' (ED25519) to the list of known hosts.
mpiuser@slave3's password:
mpiuser@habib-VirtualBox:~/.ssh$ sudo mkdir /home/mpiuser/bubble
mpiuser@habib-VirtualBox:~/.ssh$ sudo apt install nfs-kernel-server

```

3. Konfigurasi NFS pertama buat dulu folder di semua device di home dengan nama bubble atau bisa menggunakan terminal `mkdir /home/mpiuser/bubble`

setelah itu dilanjutkan dengan menginstall NFS di master

```
sudo apt install nfs-kernel-server
```

```

mpiuser@habib-VirtualBox:~$ cd .ssh
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave1 (10.1.8.224)' can't be established.
ED25519 key fingerprint is SHA256:UydkBHUXzfe2L3vAFUx1yFUDrJTloy0xVF4zMDanU+c.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave1' (ED25519) to the list of known hosts.
mpiuser@slave1's password:
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave2 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave2 (10.1.9.21)' can't be established.
ED25519 key fingerprint is SHA256:mdzDsKI/vr1HiT3/skqpVe7ZJ9cNwX5SRPx4r6SxYxk.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave2' (ED25519) to the list of known hosts.
mpiuser@slave2's password:
mpiuser@habib-VirtualBox:~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave3 "mkdir .ssh; cat >> .ssh/authorized_keys"
The authenticity of host 'slave3 (10.1.9.199)' can't be established.
ED25519 key fingerprint is SHA256:pjtG/2GUNTazfylmP77PiZQTmVt82YrxLIUKXO/YFXI.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'slave3' (ED25519) to the list of known hosts.
mpiuser@slave3's password:
mpiuser@habib-VirtualBox:~/.ssh$ sudo mkdir /home/mpiuser/bubble
mpiuser@habib-VirtualBox:~/.ssh$ sudo apt install nfs-kernel-server

```

konfigurasi nfs di master dengan path sudo nano

/etc/exports di akhir kalimat tambahkan perintah

```
/home/mpiuser/bubble *(rw,sync,no_root_squash,no_subtree_check)
```

pastikan untuk merestart Nfs server nya

```
sudo exportfs -a sudo systemctl
```

```
restart nfs-kernel-server
```

untuk bagian slave install nfs dengan perintah

```
sudo apt install nfs-
```

```
common
```

masih di slave lakukan perintah ini untuk melakukan mount folder untuk setiap slave

```
sudo mount master :/home/mpiuser/bubble /home/mpiuser/bubble
```

4.Menginstall MPI pertama install Open MPI di semua device

sudo apt install openmpi-bin libopenmpi-dev

```

mpiuser@habib-VirtualBox:~/.ssh$ sudo nano /etc/exports
mpiuser@habib-VirtualBox:~/.ssh$ sudo exportfs -a
mpiuser@habib-VirtualBox:~/.ssh$ sudo systemctl restart nfs-kernel-server
mpiuser@habib-VirtualBox:~/.ssh$ sudo apt install openmpi-bin libopenmpi-dev

```

dialanjutkan dengan mendownload Library mpi

```
sudo apt install python3-
```

```
pip pip install mpi4py
```

5.Membuat dan menjalankan File Python

Di master , buat file python di folder bubble dengan menggunakan

```
touch /home/mpiuser/bubble/bubble.py
```

kemudian isi file python tsb dengan perintah , misal : “hello world”

```
cd
```

```
/home/mpiuser/bubble
```

```
nano bubble.py
```

Jalankan file python yang baru di program dengan perintah

```
mpirun -np 4 -host master,slave1,slave2,slave3 python3 bubble.py
```



```
mpiuser@habib-VirtualBox:~/bubble$ mpirun -np 4 -host master,slave1,slave2,slave3 python3 bubble.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
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
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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
Authorization required, but no authorization protocol specified
List sorted with bubble sort in ascending order: [1, 2, 3, 4, 5]
mpiuser@habib-VirtualBox:~/bubble$ sudo nano bubble.py
mpiuser@habib-VirtualBox:~/bubble$ mpirun -np 4 -host master,slave1,slave2,slave3 python3 bubble.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
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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
Authorization required, but no authorization protocol specified
helo word
helo word
helo word
helo word
mpiuser@habib-VirtualBox:~/bubble$
```