LAPORAN

BUBBLE SORT PHYTON MPI

Disusun Oleh :

ANATA RYU ILHAMI   (09011382126168)
AGUNG RIZQI RAMADHAN   (09011382126157)
NANDA APRIADI   (09011382126170)

Dosen Pengampu :

AHMAD HERYANTO, S.Kom., M.T.

ADI HERMANSYAH, S.Kom., M.T.

SISTEM KOMPUTER

FAKULTAS ILMU KOMPUTER

UNIVERSITAS SRIWIJAYA

A. Proses Konfigurasi dan instalasi MPI

Melakukan update OS pada ketiga PC


```
ryu@hadoop-master:~$ sudo apt update && sudo apt upgrade
Ign:1 http://packages.linuxmint.com victoria InRelease
Ign:2 http://archive.ubuntu.com/ubuntu jammy InRelease
Ign:3 http://security.ubuntu.com/ubuntu jammy-security InRelease
0% [Working]
```

Melakukan konfigurasi file /etc/hosts dengan menambahakan IP dari master dan slaveuntuk kedua PC


```
File  Edit  View  Search  Terminal  Help
  GNU nano 6.2                            /etc/hosts *
127.0.0.1         localhost
127.0.1.1         ryu-virtual-machine

10.8.107.103      master
10.8.104.225      slave

# 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
```

Membuat user baru pada master dan slave dengan nama yang sama


```
tester@hadoop-master: ~
File  Edit  View  Search  Terminal  Help
ryu@hadoop-master:~$ sudo adduser tester
Adding user `tester' ...
Adding new group `tester' (1003) ...
Adding new user `tester' (1002) with group `tester' ...
Creating home directory `/home/tester' ...
Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for tester
Enter the new value, or press ENTER for the default
        Full Name []:
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] y
ryu@hadoop-master:~$ sudo usermod -aG sudo tester
ryu@hadoop-master:~$ su - tester
Password:
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

tester@hadoop-master:~$
```

Menginstall openssh pada master dan slave

Melakukan konfigurasi pada file /etc/exports yang berada pada master dengan menambahkan "/home/tester/PemroPar *(rw,sync,no_root_squash,no_subtree_check)"

Melakukan restart dan eksport pada nfs kernel

Lalu install nfs-common pada semua slave

```
tester@mpi-virtual-machine:~$ sudo apt install nfs-common
[sudo] password for tester:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
```

Melakukan mounting dan mengetes apakah shared folder sudah dapat dipakai

```
tester@mpi-virtual-machine:~$ sudo mount master:/home/tester/PemroPar /home/t
er/PemroPar
tester@mpi-virtual-machine:~$ sudo nano /home/tester/PemroPar/halo.txt
```

Terakhir, lakukan instalasi openmpi pada master dan slave

```
tester@mpi-virtual-machine:~$ sudo nano /home/tester/PemroPar/halo.txt
tester@mpi-virtual-machine:~$ sudo apt install openmpi-bin libopenmpi-dev
```

Mengetes apakah openmpi dapat berjalan

```
tester@hadoop-master: ~/PemroPar
File  Edit  View  Search  Terminal  Help
Setting up libcoarrays-openmpi-dev:amd64 (2.9.2-3) ...
update-alternatives: using /usr/lib/x86_64-linux-gnu/open-coarrays/openmpi/bin/c
af to provide /usr/bin/caf.openmpi (caf-openmpi) in auto mode
update-alternatives: using /usr/bin/caf.openmpi to provide /usr/bin/caf (caf) in
 auto mode
Processing triggers for install-info (6.8-4build1) ...
Processing triggers for doc-base (0.11.1) ...
Processing 1 added doc-base file...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
Processing triggers for man-db (2.10.2-1) ...
tester@hadoop-master:~$ cd /home/tester/PemroPar
tester@hadoop-master:~/PemroPar$ touch nyoba.py
tester@hadoop-master:~/PemroPar$ ls
halo.txt  nyoba.py
tester@hadoop-master:~/PemroPar$ vim nyoba.py
tester@hadoop-master:~/PemroPar$ mpirun -np 2 -host master,slave1 python3 nyoba.
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
tester@hadoop-master:~/PemroPar$
```

B. Bubblesort

Masuk kedalam shared folder yang telah dibuat sebelumnya lalu buat file .py, disini file dinamai BubbleSort.py

```
tester@hadoop-master:~$ cd /home/tester/PemroPar
tester@hadoop-master:~/PemroPar$ ls
halo.txt  nyoba.py
tester@hadoop-master:~/PemroPar$ touch BubbleSort.py
tester@hadoop-master:~/PemroPar$ ls
BubbleSort.py  halo.txt  nyoba.py
```

Tulis program BubbleSort dalam file tersebut

```python
from mpi4py import MPI

def bubble_sort_odd(arr):
    n = len(arr)
    for i in range(n):
        for j in range(0, n-i-1):
            if arr[j] % 2 == 1 and arr[j] > arr[j+1]:
                arr[j], arr[j+1] = arr[j+1], arr[j]

if __name__ == "__main__":
    comm = MPI.COMM_WORLD
    rank = comm.Get_rank()

    if rank == 0:
        data = [9, 3, 7, 5, 1, 8, 4, 6, 2]
    else:
        data = None

    data = comm.bcast(data, root=0)

    #menyortir angka ganjil
    local_data = [x for x in data if x % 2 == 1]
    bubble_sort_odd(local_data)

    #mengumpulkan hasil
    sorted_data = comm.gather(local_data, root=0)

    if rank == 0:
        result = []
        for sublist in sorted_data:

            result.extend(sublist)
        print("Hasil: ", result)
```

Program diatas akan melakukan bubble sort kepada sebuah array yang didalamnya terdapat angka [9, 3, 7, 5, 1, 8, 4, 6, 2] output yang akan dihasilkan merupakan urutann angka ganjil dari terkecil ke terbesar sehingga program akan mengabaikan angka yang bernilai genap.

OUTPUT:

```
tester@hadoop-master:~/PemroPar$ mpirun -np 2 -host master,slave1 python3 BubbleSort.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
Hasil:  [1, 3, 5, 7, 9, 1, 3, 5, 7, 9]
```

Dapat dilihat jika outputnya berhasil mengurutkan angka 1,3,5,7,9 dan mengabaikan angka genap