

LAPORAN RESMI
PRAKTIKUM ORGANISASI DAN ARSITEKTUR KOMPUTER



JUDUL:
MPI Master and Slave

Disusun Oleh :

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PROGRAM STUDI TEKNIK KOMPUTER
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I. Tujuan

1. Praktikum ini mampu membuat master dan slave.
2. Praktikum ini mampu mengkonfigurasi SSH.
3. Mahasiswa dalam praktikum ini akan menginstall MPI.

II. Dasar Teori

A. Definisi

Membuat konfigurasi master dan slave pada Ubuntu Server melibatkan implementasi sistem replikasi basis data untuk memastikan keberlanjutan dan redundansi data. Dua perangkat lunak manajemen basis data umum yang digunakan untuk tujuan ini adalah MySQL dan PostgreSQL. Pertama, pengguna perlu menginstal salah satu basis data ini dengan menggunakan perintah `sudo apt-get install mysql-server` untuk MySQL atau `sudo apt-get install postgresql` untuk PostgreSQL. Setelah instalasi, konfigurasi dilakukan melalui file konfigurasi khusus seperti `my.cnf` untuk MySQL atau `postgresql.conf` dan `pg_hba.conf` untuk PostgreSQL. Pada tahap ini, parameter seperti log biner dan konfigurasi replikasi ditentukan. Setelah konfigurasi selesai, restart layanan basis data untuk menerapkan perubahan. Dengan konfigurasi ini, master dan slave akan berkomunikasi, dan data yang ada di master secara otomatis akan disalin ke slave, memberikan ketahanan dan keandalan sistem basis data.

Proses konfigurasi master dan slave ini memerlukan pemahaman mendalam tentang konsep replikasi basis data dan konfigurasi sistem, serta diperlukan keterampilan menggunakan command prompt pada Ubuntu Server. Penting untuk merujuk pada dokumentasi resmi dari MySQL atau PostgreSQL dan memahami kebutuhan spesifik sistem sebelum memulai proses konfigurasi ini.

III. Kegiatan Praktikum

Komponen yang diperlukan :

1. Virtual Machine (Virtual Box 7.0.12)
2. File Iso Linux Ubuntu
3. Command Prompt

User>ssh ubuntu@IP

User>ssh azza@10.1.11.194

```
azza@azza: ~
Microsoft Windows [Version 10.0.22631.2715]
(c) Microsoft Corporation. All rights reserved.

C:\Users\User>ssh azza@10.1.11.194
The authenticity of host '10.1.11.194 (10.1.11.194)' can't be established.
ED25519 key fingerprint is SHA256:DtAAQDQ0ef8tx2fe2vjN7I2aLQiMjqwVamJYCMOPjs
s.
This host key is known by the following other names/addresses:
  C:\Users\User/.ssh/known_hosts:5: 192.168.1.8
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.1.11.194' (ED25519) to the list of known host
```

Enter your password

```
azza@10.1.11.194's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-88-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Tue Nov 21 08:55:24 AM UTC 2023

System load:  0.14501953125      Processes:           124
Usage of /:   49.8% of 11.21GB   Users logged in:    1
Memory usage: 38%               IPv4 address for enp0s3: 10.1.11.194
Swap usage:   0%
```

azza@azza:~/.ssh\$ sudo apt install python3-pip

```
azza@azza:~/.ssh$ sudo apt install python3-pip
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  build-essential dpkg-dev fakeroot g++ g++-11 libalgorithm-diff-perl
  libalgorithm-diff-xs-perl libalgorithm-merge-perl libdpkg-perl
  libexpat1-dev libfakeroot libfile-fcntllock-perl libjs-sphinxdoc
  libjs-underscore libpython3-dev libpython3.10-dev libstdc++-11-dev
  lto-disabled-list make python3-dev python3-wheel python3.10-dev
Suggested packages:
  python3-doc python3-tk python3-venv python3.10-doc binutils-dev
  glibc-doc make-doc libstdc++-11-doc
The following NEW packages will be installed:
  python3-pip
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
```

azza@azza:~/.ssh\$ sudo apt install openssh-server

```
azza@azza:~/.ssh$ sudo apt install openssh-server
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3ubuntu0.4).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

azza@azza:~\$ ssh-keygen -t rsa

```
azza@azza:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/azza/.ssh/id_rsa): /home/azza/.ssh/id_rsa
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Saving key "/home/azza/.ssh/id_rsa" failed: No such file or directory
```

azza@azza:~/.ssh\$ cd .ssh

azza@azza:~/.ssh\$ cat id_rsa.pub | ssh azza@slave3 "mkadir .ssh; cat >> .ssh/authorized_keys"

```

azza@azza:~$ cd .ssh
azza@azza:~/.ssh$ cat id_rsa.pub | ssh azza@slave3 "mkdir .ssh; cat >> .ssh/authorized_keys"
cat: id_rsa.pub: No such file or directory
ssh: Could not resolve hostname slave3: Temporary failure in name resolution
azza@azza:~/.ssh$ ssh-
Generating public/private rsa key pair.
Enter file in which to save the key (/home/azza/.ssh/id_rsa): /home/azza/.ssh/id_rsa
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Saving key "/home/azza/.ssh/id_rsa" failed: No such file or directory

```

azza@azza:~/.ssh\$ **mkdir /home/azza/bubble**
 azza@azza:~/.ssh\$ **sudo apt install nfs-kernel-server**

```

azza@azza:~/.ssh$ mkdir /home/azza/bubble
azza@azza:~/.ssh$ sudo apt install nfs-kernel-server
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).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

```

azza@azza:~/.ssh\$ **/home/azza/bubble *(rw,sync,no_root_squash,no_subtree_check-bash**

azza@azza:~/.ssh\$ **sudo exportfs -a**

azza@azza:~/.ssh\$ **sudo systemctl restart nfs-kernel-server**

azza@azza:~/.ssh\$ **sudo apt install cfs-common**

```

0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
azza@azza:~/.ssh$ /home/azza/bubble *(rw,sync,no_root_squash,no_subtree_check)
-bash: /home/azza/bubble: Is a directory
azza@azza:~/.ssh$ sudo exportfs -a
azza@azza:~/.ssh$ sudo systemctl restart nfs-kernel-server
azza@azza:~/.ssh$ sudo apt install nfs-common
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nfs-common is already the newest version (1:2.6.1-1ubuntu1.2).
nfs-common set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

```

azza@azza:~/.ssh\$ **sudo apt install openmpi-bin libopenmpi-dev**

```

azza@azza:~/.ssh$ sudo apt install openmpi-bin libopenmpi-dev
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:

```

```
azza@azza: ~/bubble
GNU nano 6.2 bubble.py
from mpi4py import MPI

def parallel_bubble_sort(arr):
    comm = MPI.COMM_WORLD
    rank = comm.Get_rank()
    size = comm.Get_size()

    local_arr = arr[rank::size]

    for i in range(len(local_arr)):
        for j in range(0, len(local_arr) - i - 1):
            if local_arr[j] > local_arr[j + 1]:
                local_arr[j], local_arr[j + 1] = local_arr[j + 1], local_arr[j]

    sorted_arr = comm.gather(local_arr, root=0)

    if rank == 0:
        combined_arr = [item for sublist in sorted_arr for item in sublist]
        combined_arr.sort()
        for i in range(len(arr)):
            arr[i] = combined_arr[i]

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

    if rank == 0:
        arr = [5, 3, 4, 1, 2]
    else:
        arr = None

^G Help      ^O Write Out  ^W Where Is   ^K Cut        [ Read 39 lines ]
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^T Execute
^_           ^J Justify    ^C
```

Creating Master and Slave

Buat user baru dengan perintah berikut pada master dan masing-masing slave:

```
azza@azza:~/bubble sudo adduser mpiuser
```

```
azza@azza:~/bubble su - mpiuser
```

```
azza@azza:~/bubble sudo apt update && sudo apt upgrade
```

```
azza@azza:~/bubble sudo apt install net-tools vim
```

Konfigurasi file /etc/hosta pada master, slave1, slave2, slave3. Daftarkan IP dan nama host masing-masing komputer

SSH Configuration

Instal openSSH pada master dan slave

```
azza@azza:~/bubble sudo apt install openssh-server
```

```
azza@azza:~/bubble ssh-keygen -t rsa
```

```
azza@azza:~/bubble cd .ssh
```

```
cat id_rsa.pub | ssh azza@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
```

Ulangi perintah untuk setiap slave.

NFS Configuration

Buat folder bersama pada master dan masing-masing slave

```
azza@azza:~/bubble mkdir /home/azza/bubble
```

```
azza@azza:~/bubble sudo apt install nfs-kernel-server
```

```
azza@azza:~/bubble /home/azza/bubble *(rw,sync,no_root_squash,no_subtree_check)
```

```
azza@azza:~/bubble sudo exportfs -a
```

```
sudo systemctl restart nfs-kernel-server
```

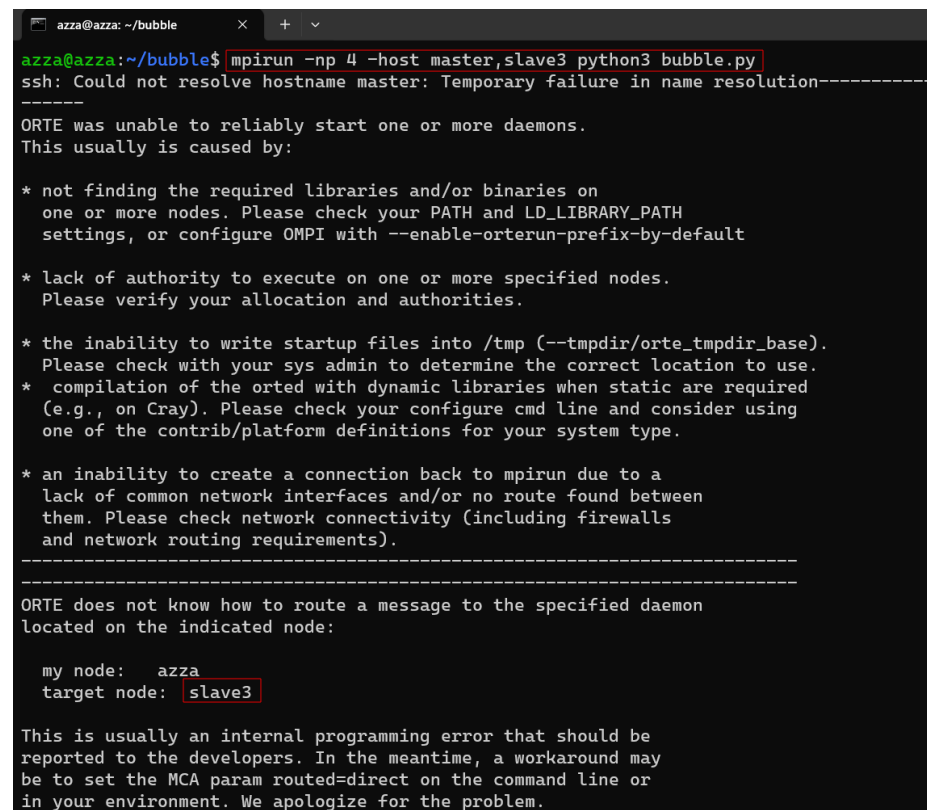
```
azza@azza:~/bubble sudo apt install nfs-common
azza@azza:~/bubble sudo mount master:/home/mpiuser/bubble /home/mpiuser/bubble
```

MPI Installation

```
azza@azza:~/bubble sudo apt install openmpi-bin libopenmpi-dev
azza@azza:~/bubble sudo apt install python3-pip
pip install mpi4py
```

Kemudian buat kode Python Bubble Sort. Simpan dengan menekan CTRL + X lalu tekan Y.
Kode bubble.py <https://github.com/NauvalPerdana/MPI-Python-BubbleSort/blob/main/bubble.py>

```
azza@azza:~/ssh$ mpirun -np 4 -hosts master, slave3 python3 bubble.py
```

A terminal window titled 'azza@azza: ~/bubble' showing the execution of the command 'mpirun -np 4 -host master,slave3 python3 bubble.py'. The command is highlighted with a red box. The output shows an error from ssh: 'Could not resolve hostname master: Temporary failure in name resolution'. This is followed by a message from ORTE stating it was unable to reliably start one or more daemons and listing several possible causes. The message is followed by a list of five bullet points explaining common issues: not finding libraries, lack of authority, inability to write startup files, compilation issues, and inability to create a connection. Below this, another message states 'ORTE does not know how to route a message to the specified daemon located on the indicated node:'. This is followed by a summary of the nodes: 'my node: azza' and 'target node: slave3', with 'slave3' highlighted by a red box. The final message states that this is usually an internal programming error and suggests a workaround of setting the MCA param 'routed=direct'.