

**TUGAS LAPORAN  
PRAKTIKUM ARSITEKTUR DAN ORGANISASI KOMPUTER**

**MPI-BubbleSort**

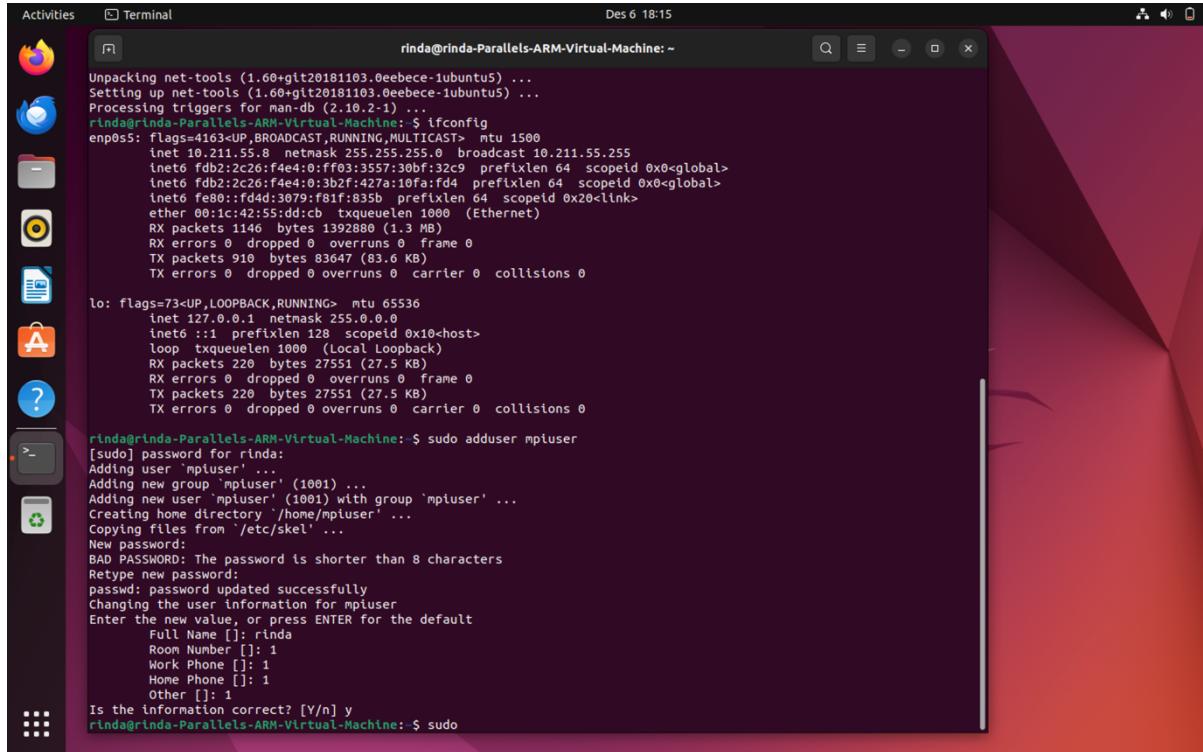


Disusun oleh:  
Rinda Ambarwati Putri  
09030582226015

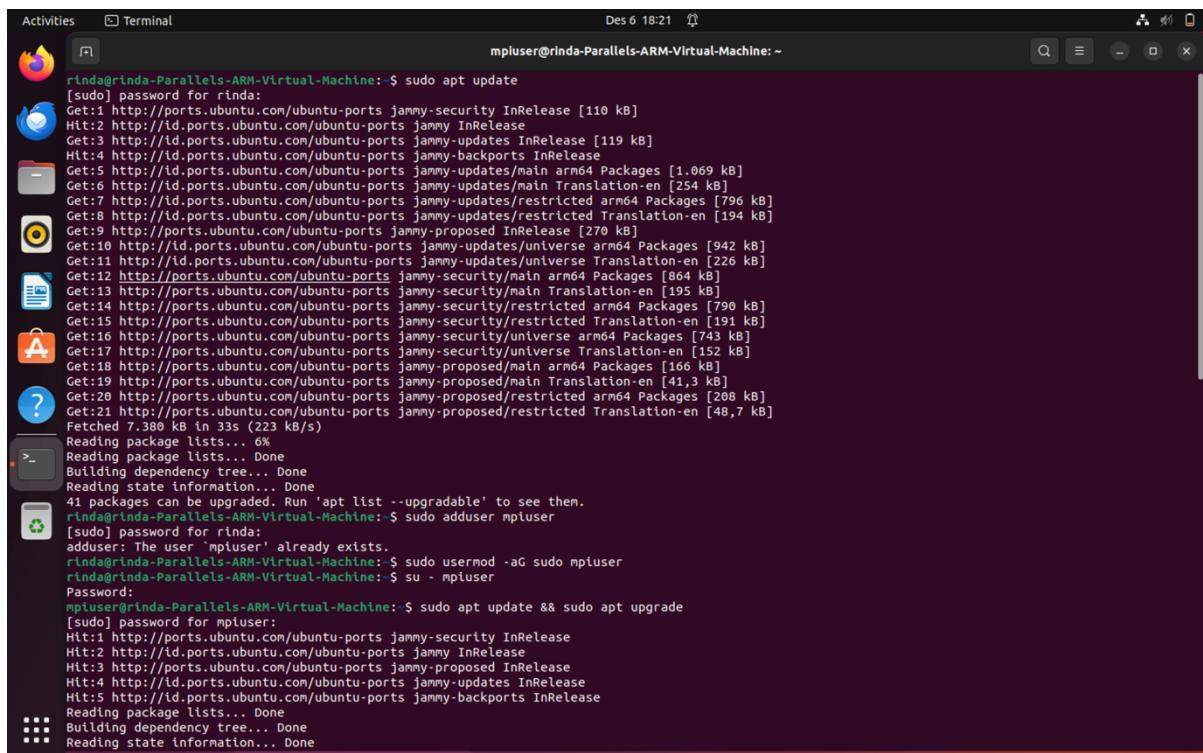
Dosen Pengampu  
ADI HERMANSYAH, S.KOM., M.T.

**UNIVERSITAS SRIWIJAYA  
FAKULTAS ILMU KOMPUTER  
TEKNIK KOMPUTER  
(TK3A)  
2023**

## Creating Master and Slave



```
Activities Terminal Des 6 18:15
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ ifconfig
Unpacking net-tools (1.60+git20181103.0eebece~ubuntus) ...
Setting up net-tools (1.60+git20181103.0eebece~ubuntus) ...
Processing triggers for man-db (2.10.2-1) ...
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ ifconfig
enp0s5: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.211.55.8 netmask 255.255.255.0 broadcast 10.211.55.255
                inet6 fdb2:2c26:f4e4:0:3bf2:427a:10fa:fd4 prefixlen 64 scoprid 0x0<global>
                inet6 fe80::2c26:f4e4:3bf2:427a%1 linklayer
inet6 fe80::fe80:dd:cb txqueuelen 1000 (Ethernet)
        ether 00:01:c4:42:55:dd brd 10:00:00:00:00:00
        RX packets 1146 bytes 1392880 (1.3 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 910 bytes 83647 (83.6 KB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
        inet 127.0.0.1 netmask 255.0.0.0
                inet6 ::1 prefixlen 128 scoprid 0x10<host>
                loop txqueuelen 1000 (Local Loopback)
                RX packets 220 bytes 27551 (27.5 KB)
                RX errors 0 dropped 0 overruns 0 frame 0
                TX packets 220 bytes 27551 (27.5 KB)
                TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ sudo adduser mpiuser
[sudo] password for rinda:
Adding user 'mpiuser' ...
Adding new group 'mpiuser' (1001) ...
Adding new user 'mpiuser' (1001) with group 'mpiuser' ...
Creating home directory '/home/mpiuser' ...
Copying files from '/etc/skel' ...
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: password updated successfully
Changing the user information for mpiuser
Enter the new value, or press ENTER for the default
    Full Name []: rinda
    Room Number []: 1
    Work Phone []: 1
    Home Phone []: 1
    Other []: 1
Is the information correct? [Y/n] y
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ sudo
```



```
Activities Terminal Des 6 18:21
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ sudo apt update
[sudo] password for rinda:
Get:1 http://ports.ubuntu.com/ubuntu-ports jammy-security InRelease [110 kB]
Hit:2 http://id.ports.ubuntu.com/ubuntu-ports jammy InRelease
Get:3 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates InRelease [119 kB]
Hit:4 http://id.ports.ubuntu.com/ubuntu-ports jammy-backports InRelease
Get:5 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/main arm64 Packages [1.069 kB]
Get:6 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/main Translation-en [254 kB]
Get:7 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/restricted arm64 Packages [796 kB]
Get:8 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/restricted Translation-en [194 kB]
Get:9 http://ports.ubuntu.com/ubuntu-ports jammy-proposed InRelease [270 kB]
Get:10 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/universe arm64 Packages [942 kB]
Get:11 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/universe Translation-en [226 kB]
Get:12 http://ports.ubuntu.com/ubuntu-ports jammy-security/main arm64 Packages [864 kB]
Get:13 http://ports.ubuntu.com/ubuntu-ports jammy-security/restricted arm64 Packages [790 kB]
Get:14 http://ports.ubuntu.com/ubuntu-ports jammy-security/universe arm64 Packages [191 kB]
Get:15 http://ports.ubuntu.com/ubuntu-ports jammy-security/universe Translation-en [152 kB]
Get:16 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/main arm64 Packages [743 kB]
Get:17 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/universe arm64 Packages [166 kB]
Get:18 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/main Translation-en [41,3 kB]
Get:19 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/restricted arm64 Packages [208 kB]
Get:20 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/restricted Translation-en [48,7 kB]
Fetched 7.380 kB in 33s (223 kB/s)
Reading package lists... 0%
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ sudo adduser mpiuser
[sudo] password for rinda:
adduser: The user 'mpiuser' already exists.
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ sudo usermod -aG sudo mpiuser
rinda@rinda-Parallels-ARM-Virtual-Machine:~$ su - mpiuser
Password:
mpiuser@rinda-Parallels-ARM-Virtual-Machine:~$ sudo apt update && sudo apt upgrade
[sudo] password for mpiuser:
Hit:1 http://ports.ubuntu.com/ubuntu-ports jammy-security InRelease
Hit:2 http://id.ports.ubuntu.com/ubuntu-ports jammy InRelease
Hit:3 http://ports.ubuntu.com/ubuntu-ports jammy-proposed InRelease
Hit:4 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates InRelease
Hit:5 http://id.ports.ubuntu.com/ubuntu-ports jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
```

```
Activities Terminal Des 6 18:22 ⓘ
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~
Building dependency tree... Done
Reading state information... Done
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
rinda@rinda-Parallels-ARM-Virtual-Machine: $ sudo adduser mpiuser
[sudo] password for rinda:
adduser: The user 'mpiuser' already exists.
rinda@rinda-Parallels-ARM-Virtual-Machine: $ sudo usermod -aG sudo mpiuser
rinda@rinda-Parallels-ARM-Virtual-Machine: $ su - mpiuser
Password:
mpiuser@rinda-Parallels-ARM-Virtual-Machine: $ sudo apt update && sudo apt upgrade
[sudo] password for mpiuser:
Hit:1 http://ports.ubuntu.com/ubuntu-ports jammy-security InRelease
Hit:2 http://id.ports.ubuntu.com/ubuntu-ports jammy InRelease
Hit:3 http://ports.ubuntu.com/ubuntu-ports jammy-proposed InRelease
Hit:4 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates InRelease
Hit:5 http://id.ports.ubuntu.com/ubuntu-ports jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnappy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
Get more security updates through Ubuntu Pro with 'esm-apps' enabled:
  libjs-jquery-ui php-twig libpmix-dev libpmix2
Learn more about Ubuntu Pro at https://ubuntu.com/pro
The following packages will be upgraded:
  alsa-ucm-conf apache2 apache2-bin apache2-data apache2-utils libfreerdp-client2-2 libfreerdp-server2-2 libfreerdp2-2 libgnutls30 libnghttp2-14
  libperl5.34 libpoppler-cpp0v5 libpoppler-glib8 libpoppler118 libpython3.10 libpython3.10-dev libpython3.10-minimal libpython3.10-stdlib libtiff5
  libwinpr2-2 openvpn perl perl-base perl-modules-5.34 poppler-utils python3-software-properties python3-update-manager python3.10 python3.10-dev
  python3.10-minimal software-properties-common software-properties-gtk systemd-hwe-hwdb thunderbird thunderbird-gnome-support thunderbird-locale-en
  thunderbird-locale-en-us tracker-extract tracker-miner-fs update-manager update-manager-core
41 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
32 standard LTS security updates
Need to get 92,4 MB of archives.
After this operation, 58,2 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ports.ubuntu.com/ubuntu-ports jammy-proposed/main arm64 python3-update-manager all 1:22.04.17 [39,0 kB]
Get:2 http://id.ports.ubuntu.com/ubuntu-ports jammy-updates/main arm64 libperl5.34 arm64 5.34.0-3ubuntu1.3 [4,723 kB]
```

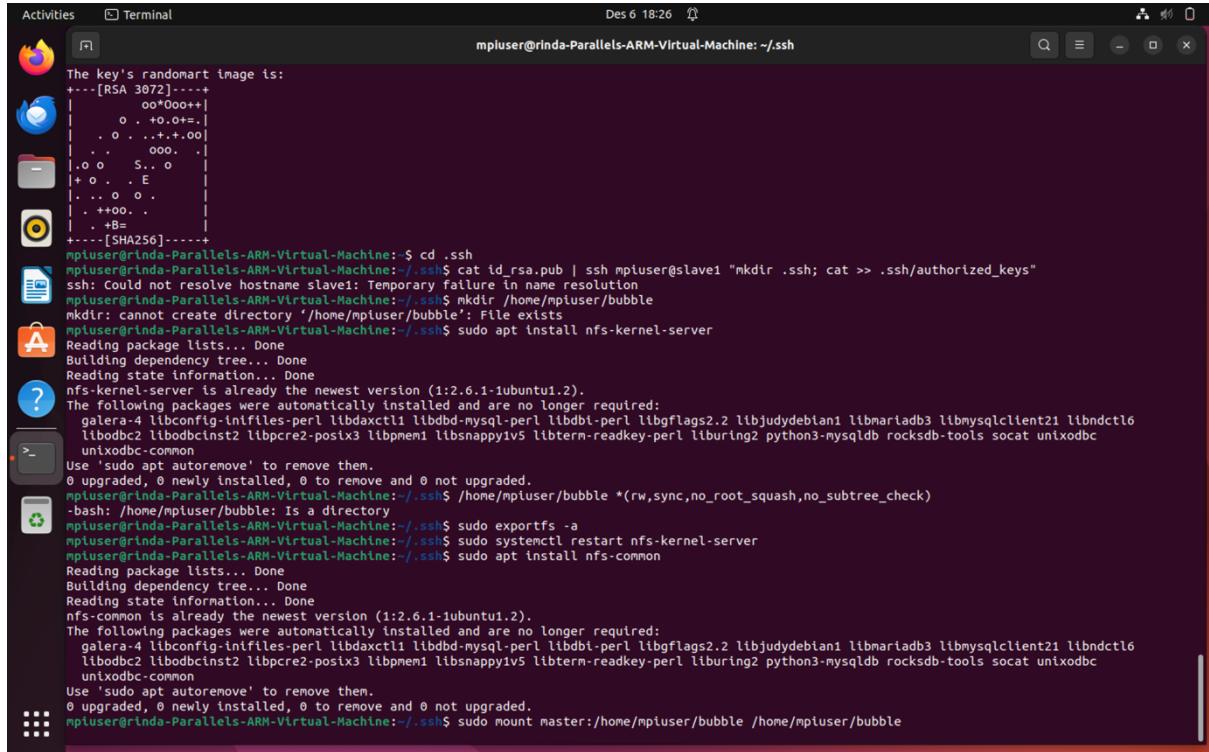
```
Activities Terminal Des 6 18:22 ⓘ
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~
Setting up libpoppler118:arm64 (22.02.0-2ubuntu0.3) ...
Setting up thunderbird-locale-en-us (1:115.5.0+build1~Ubuntu0.22.04.1) ...
Setting up perl (5.34.0-3ubuntu1.3) ...
Setting up thunderbird-gnome-support (1:115.5.0+build1~Ubuntu0.22.04.1) ...
Setting up update-manager-core (1:22.04.17) ...
Setting up libfreerdp-server2-2:arm64 (2.6.1+dfsg1-3ubuntu2.5) ...
Setting up poppler-utils (22.02.0-2ubuntu0.3) ...
Setting up libpoppler-cpp0v5:arm64 (22.02.0-2ubuntu0.3) ...
Setting up libfreerdp-client2-2:arm64 (2.6.1+dfsg1-3ubuntu2.5) ...
Setting up libpython3.10:arm64 (3.10.12-1-22.04.3) ...
Setting up libpoppler-glib8:arm64 (22.02.0-2ubuntu0.3) ...
Setting up python3.10 (3.10.12-1-22.04.3) ...
Setting up tracker-extract (3.3.3-0ubuntu0.20.04.1) ...
Setting up software-properties-gtk (0.99.22.9) ...
Setting up update-manager (1:22.04.17) ...
Setting up apache2-bin (2.4.52-1ubuntu4.7) ...
Setting up libpython3.10-dev:arm64 (3.10.12-1-22.04.3) ...
Setting up python3.10-dev (3.10.12-1-22.04.3) ...
Setting up apache2 (2.4.52-1ubuntu4.7) ...
apache2-htcacache-clean.service is a disabled or a static unit not running, not starting it.
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for shared-mime-info (2.1-2) ...
Processing triggers for udev (249.11-0ubuntu3.11) ...
Processing triggers for malicap (3.70+mu1ubuntu1) ...
Processing triggers for desktop-file-utils (0.26-1ubuntu3) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-ubuntu3) ...
Processing triggers for libglib2.0-0:arm64 (2.72.4-0ubuntu2.2) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
Processing triggers for ufw (0.36.1-4ubuntu0.1) ...
Processing triggers for man-db (2.10.2-1) ...
Setting up tracker-miner-fs (3.3.3-0ubuntu0.20.04.1) ...
mpiuser@rinda-Parallels-ARM-Virtual-Machine: $ sudo apt install net-tools vim
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
net-tools is already the newest version (1.60+git20181103.0eebece-1ubuntu5).
vim is already the newest version (2:8.2.3995-1ubuntu2.13).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnappy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: $
```

## SSH Configuration

```
Activities Terminal Des 6 18:24
mpluser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh
Reading state information... Done
net-tools is already the newest version (1.60+git201103.0eebece-1ubuntu5).
vim is already the newest version (2:8.2.3995-1ubuntu2.13).
The following packages were automatically installed and are no longer required:
galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnapy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3ubuntu0.4).
The following packages were automatically installed and are no longer required:
galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnapy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/mpluser/.ssh/id_rsa):
/home/mpluser/.ssh/id_rsa already exists.
Overwrite (y/n)? y
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/mpluser/.ssh/id_rsa
Your public key has been saved in /home/mpluser/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:e+Aqh4/BApjobbcBRpddr9FnPcQAAZUF3hV50QItfqI mpluser@rinda-Parallels-ARM-Virtual-Machine
The key's randomart image is:
+---[RSA 3072]----+
|          o*0oo++|
|       . +o.+=-.| |
|    . o . +.-+.oo|
|     . . . 000. . |
|    .o o   S.. 0  |
|+ o .   . E      |
|... o o   .       |
| .. +oo. .       |
| . . +B=         |
+---[SHA256]----+
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ cd .ssh
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$
```

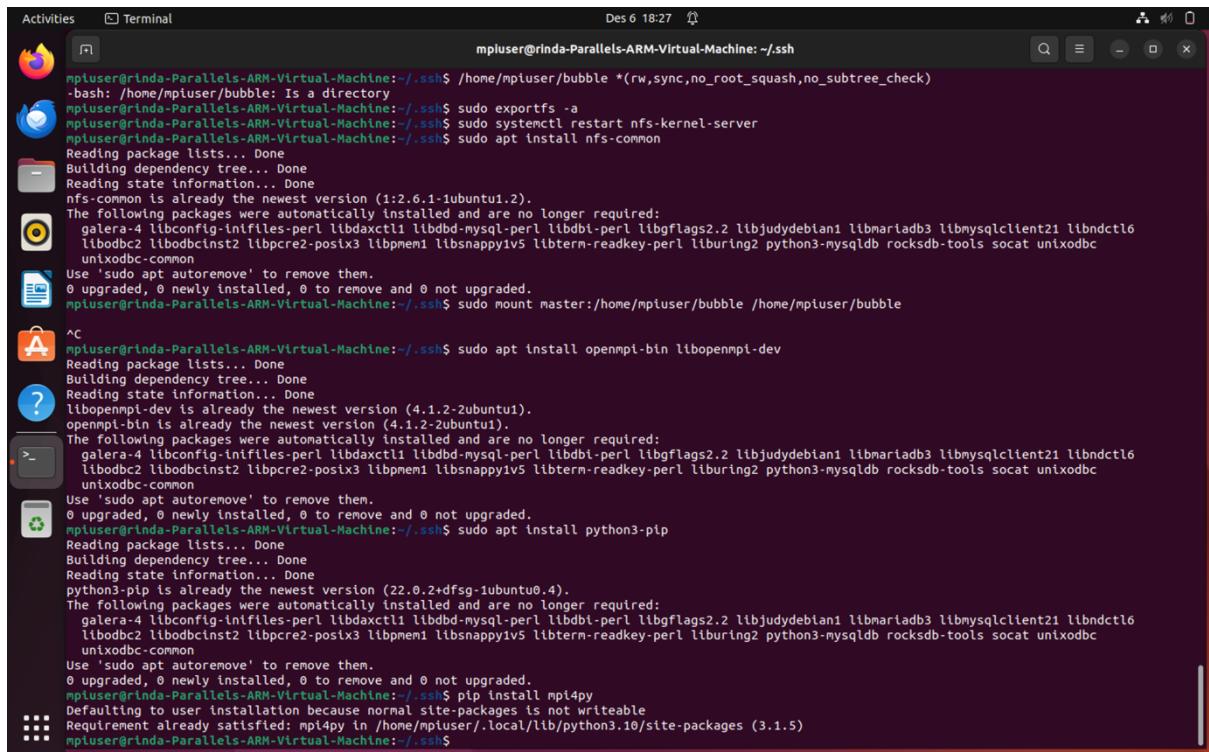
```
Activities Terminal Des 6 18:24
mpluser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh
Reading state information... Done
vim is already the newest version (2:8.2.3995-1ubuntu2.13).
The following packages were automatically installed and are no longer required:
galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnapy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3ubuntu0.4).
The following packages were automatically installed and are no longer required:
galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsnapy1v5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/mpluser/.ssh/id_rsa):
/home/mpluser/.ssh/id_rsa already exists.
Overwrite (y/n)? y
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/mpluser/.ssh/id_rsa
Your public key has been saved in /home/mpluser/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:e+Aqh4/BApjobbcBRpddr9FnPcQAAZUF3hV50QItfqI mpluser@rinda-Parallels-ARM-Virtual-Machine
The key's randomart image is:
+---[RSA 3072]----+
|          o*0oo++|
|       . +o.+=-.| |
|    . o . +.-+.oo|
|     . . . 000. . |
|    .o o   S.. 0  |
|+ o .   . E      |
|... o o   .       |
| .. +oo. .       |
| . . +B=         |
+---[SHA256]----+
mpluser@rinda-Parallels-ARM-Virtual-Machine: $ cd .ssh
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$ cat id_rsa.pub | ssh mpluser@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
ssh: Could not resolve hostname slave1: Temporary failure in name resolution
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$
```

## NFS Configuration



```
The key's randomart image is:
+---[RSA 3072]----+
|          oo*0oo++|
|         o . +o.o+..|
|        . o . .+.oo.|
|       . . . . 000. .|
|      .o o . 5.. o |
|     [+ o . . E|
|    . . . o o .|
|   . . ++oo. .|
|  . . .+B=|
+---[SHA256]----+
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ cat id_rsa.pub | ssh mpiuser@slave1 "mkdir .ssh; cat >> .ssh/authorized_keys"
ssh: Could not resolve hostname slave1: Temporary failure in name resolution
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ mkdir /home/mpiuser/bubble
mkdir: cannot create directory '/home/mpiuser/bubble': File exists
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.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).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsappiy5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ /home/mpiuser/bubble *(rw,sync,no_root_squash,no_subtree_check)
bash: /home/mpiuser/bubble: Is a directory
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo exportfs -a
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo systemctl restart nfs-kernel-server
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.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).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsappiy5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo mount master:/home/mpiuser/bubble /home/mpiuser/bubble
```

## MPI Installation



```
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh
-bash: /home/mpiuser/bubble: Is a directory
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo exportfs -a
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo systemctl restart nfs-kernel-server
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.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).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsappiy5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo mount master:/home/mpiuser/bubble /home/mpiuser/bubble
^C
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo apt install openmpi-bin libopenmpi-dev
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
libopenmpi-dev is already the newest version (4.1.2-2ubuntu1).
openmpi-bin is already the newest version (4.1.2-2ubuntu1).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsappiy5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ sudo apt install python3-pip
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3-pip is already the newest version (22.0.2+dfsg-1ubuntu0.4).
The following packages were automatically installed and are no longer required:
  galera-4 libconfig-inifiles-perl libdaxctl1 libdbd-mysql-perl libdbi-perl libgflags2.2 libjudydebian1 libmariadb3 libmysqlclient21 libndctl16
  libodbc2 libodbcinst2 libpcre2-posix3 libpmem1 libsappiy5 libterm-readkey-perl liburing2 python3-mysqldb rocksdb-tools socat unixodbc
  unixodbc-common
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$ pip install mpi4py
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: mpi4py in /home/mpiuser/.local/lib/python3.10/site-packages (3.1.5)
mpiuser@rinda-Parallels-ARM-Virtual-Machine: ~/.ssh$
```

```
Activities Terminal Des 6 18:29 ⓘ
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$ pip install mpi4py
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: mpi4py in /home/mpluser/.local/lib/python3.10/site-packages (3.1.5)
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$ touch /home/mpluser/bubble/bubble.py
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/.ssh$ cd /home/mpluser/bubble
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/bubble$ nano bubble.py
y: command not found
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/bubble$ mpirun -np 4 -host master,slave1,slave2,slave3 python3 bubble.py
Authorization required, but no authorization protocol specified
ssh: Could not resolve hostname master: Temporary failure in name resolution
ssh: Could not resolve hostname slave3: Temporary failure in name resolution
ssh: Could not resolve hostname slave1: Temporary failure in name resolution
ssh: Could not resolve hostname slave2: Temporary failure in name resolution
-----
ORTE was unable to reliably start one or more daemons.
This usually is caused by:
  * not finding the required libraries and/or binaries on
    one or more nodes. Please check your PATH and LD_LIBRARY_PATH
    settings, or configure MPI with --enable-orterun-prefix-by-default
  * lack of authority to execute on one or more specified nodes.
    Please verify your allocation and authorities.
  * the inability to write startup files into /tmp (--tmpdir/orte_tmpdir_base).
    Please check with your sys admin to determine the correct location to use.
  * compilation of the orted with dynamic libraries when static are required
    (e.g., on Cray). Please check your configure cmd line and consider using
    one of the contrib/platform definitions for your system type.
  * an inability to create a connection back to mpirun due to a
    lack of common network interfaces and/or no route found between
    them. Please check network connectivity (including firewalls
    and network routing requirements).
-----
ORTE does not know how to route a message to the specified daemon
located on the indicated node:
my node: rinda-Parallels-ARM-Virtual-Machine
```

## Running Python Code - Bubble Sort

```
Activities Terminal Des 6 18:29 ⓘ
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/bubble$ Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
Authorization required, but no authorization protocol specified
ssh: Could not resolve hostname master: Temporary failure in name resolution
ssh: Could not resolve hostname slave3: Temporary failure in name resolution
ssh: Could not resolve hostname slave1: Temporary failure in name resolution
ssh: Could not resolve hostname slave2: Temporary failure in name resolution
-----
ORTE was unable to reliably start one or more daemons.
This usually is caused by:
  * not finding the required libraries and/or binaries on
    one or more nodes. Please check your PATH and LD_LIBRARY_PATH
    settings, or configure MPI with --enable-orterun-prefix-by-default
  * lack of authority to execute on one or more specified nodes.
    Please verify your allocation and authorities.
  * the inability to write startup files into /tmp (--tmpdir/orte_tmpdir_base).
    Please check with your sys admin to determine the correct location to use.
  * compilation of the orted with dynamic libraries when static are required
    (e.g., on Cray). Please check your configure cmd line and consider using
    one of the contrib/platform definitions for your system type.
  * an inability to create a connection back to mpirun due to a
    lack of common network interfaces and/or no route found between
    them. Please check network connectivity (including firewalls
    and network routing requirements).
-----
ORTE does not know how to route a message to the specified daemon
located on the indicated node:
my node: rinda-Parallels-ARM-Virtual-Machine
target node: slave1

This is usually an internal programming error that should be
reported to the developers. In the meantime, a workaround may
be to set the MCA param routed=direct on the command line or
in your environment. We apologize for the problem.
[::: rinda-Parallels-ARM-Virtual-Machine:25284] 2 more processes have sent help message help-errmgr-base.txt / no-path
[::: rinda-Parallels-ARM-Virtual-Machine:25284] Set MCA parameter "orte_base_help_aggregate" to 0 to see all help / error messages
mpluser@rinda-Parallels-ARM-Virtual-Machine:~/bubble$
```

## KESIMPULAN

Laporan ini merekam upaya instalasi MPI yang menghadapi sejumlah kendala, mengakibatkan kegagalan dalam mencapai implementasi yang sukses. Beberapa poin kunci dapat diidentifikasi dari proses ini. Identifikasi masalah yang utama melibatkan pesan kesalahan yang tidak dapat diatasi selama instalasi. Faktor penyebab kegagalan melibatkan sejumlah kemungkinan, termasuk konflik versi, dependensi yang tidak terpenuhi, dan potensi masalah kompatibilitas. Langkah-langkah pemecahan masalah telah diambil, termasuk verifikasi dependensi, pemeriksaan konfigurasi, dan eksperimen dengan variasi opsi instalasi.

Meskipun upaya pemecahan masalah telah dilakukan, hasilnya belum memuaskan. Kegagalan instalasi MPI berdampak pada penundaan implementasi yang diinginkan, menghambat proyek dalam mencapai tujuan yang telah ditetapkan. Rekomendasi untuk pemulihan termasuk peninjauan lebih lanjut terhadap dependensi, eksplorasi alternatif MPI versi, dan pembaruan konfigurasi sistem.

Dalam konteks ini, penting untuk mencatat bahwa instalasi MPI menjadi kunci untuk kesuksesan proyek ini, karena MPI berperan dalam mendukung komunikasi dan koordinasi antar proses. Oleh karena itu, pemecahan masalah ini tidak hanya bersifat teknis, tetapi juga memegang peranan krusial dalam mencapai tujuan dan tenggat waktu proyek.

Kesimpulan ini mencerminkan tantangan yang dihadapi dalam instalasi MPI, serta memberikan pandangan terperinci tentang upaya yang telah dilakukan dan rekomendasi untuk melangkah ke depan guna mengatasi masalah tersebut.