

# NASA HW9 - 金哲安(B12902118)

## 第一部分：系統環境與 NFS 基礎安裝 (30pts)

### Note

Word wrap is enabled for code blocks!

### References

- B12902116 (林靖昀)
- B12902066 (宋和峻)
- <https://blog.tigernaxo.com/posts/linux/ubuntu204-static-ip/>
- [https://docs.google.com/presentation/d/12CehpBWNYFjKwv4hO1BSLZGJz\\_u0fkogbm1qKortKys/edit#slide=id.g34fc70a50b1\\_0\\_31](https://docs.google.com/presentation/d/12CehpBWNYFjKwv4hO1BSLZGJz_u0fkogbm1qKortKys/edit#slide=id.g34fc70a50b1_0_31)

### Explanation

On the server, modify `/etc/exports`

```
/srv/nfs-share 192.151.9.14(rw,sync,fsid=0,crossmnt,no_subtree_check)
192.151.9.15(rw,sync,fsid=0,crossmnt,no_subtree_check)
```

And then execute

```
sudo chown 1000:1000 /srv/nfs-share
sudo chmod 755 /srv/nfs-share
sudo exportfs -arv
sudo systemctl enable --now nfs-server
```

Then on each client

```
sudo mkdir -p /mnt/nfs-share
sudo mount -t nfs 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

1

```
anthonys - b12902118@nasa-ws3:~/tmp2/nasa/HW9 - ssh - nws - 206x57
inituser@nfs-server:/srv/nfs-share$ systemctl status nfs-kernel-server
● nfs-server.service - NFS server and services
  Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: enabled)
  Drop-In: /run/systemd/generator/nfs-server.service.d
    └─order-with-mounts.conf
    Active: active (exited) since Sat 2025-05-03 11:56:04 UTC; 38min ago
      Main PID: 825 (code=exited, status=0/SUCCESS)
        CPU: 17ms

May 03 11:56:03 nfs-server systemd[1]: Starting nfs-server.service - NFS server and services...
May 03 11:56:04 nfs-server systemd[1]: Finished nfs-server.service - NFS server and services.
inituser@nfs-server:/srv/nfs-share$ 
```

---

```
inituser@hpc1:/mnt/nfs-share$ 
```

---

```
inituser@hpc2:/mnt/nfs-share$ 
```

[gemu\_vms]0:gemu-system-x86\_64- 1:ssh\_vms\* "nasa-ws3" 20:34 03-May-25

2

```
anthonys - b12902118@nasa-ws3:~/tmp2/nasa/HW9 - ssh - nws - 206x57
inituser@nfs-server:/srv/nfs-share$ systemctl status nfs-kernel-server
● nfs-server.service - NFS server and services
  Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: enabled)
  Drop-In: /run/systemd/generator/nfs-server.service.d
    └─order-with-mounts.conf
    Active: active (exited) since Sat 2025-05-03 11:56:04 UTC; 38min ago
      Main PID: 825 (code=exited, status=0/SUCCESS)
        CPU: 17ms

May 03 11:56:03 nfs-server systemd[1]: Starting nfs-server.service - NFS server and services...
May 03 11:56:04 nfs-server systemd[1]: Finished nfs-server.service - NFS server and services.
inituser@nfs-server:/srv/nfs-share$ 
```

---

```
inituser@hpc1:/mnt/nfs-share$ mount | grep /srv/nfs-share
192.151.9.13:/srv/nfs-share on /mnt/nfs-share type nfs (rw,relatime,vers=3,rsize=1048576,wsize=1048576,
namelen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,mountaddr=192.151.9.13,mountvers=3,mountport=4521
,mountproto=udp,local_lock=none,addr=192.151.9.13)
inituser@hpc1:/mnt/nfs-share$ 
```

---

```
inituser@hpc2:/mnt/nfs-share$ mount | grep /srv/nfs-share
192.151.9.13:/srv/nfs-share on /mnt/nfs-share type nfs (rw,relatime,vers=3,rsize=1048576,wsize=1048576
,namelen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,mountaddr=192.151.9.13,mountvers=3,mountport=45
213,mountproto=udp,local_lock=none,addr=192.151.9.13)
inituser@hpc2:/mnt/nfs-share$ 
```

[gemu\_vms]0:gemu-system-x86\_64- 1:ssh\_vms\* "nasa-ws3" 20:37 03-May-25

```

inituser@nfs-server:/srv/nfs-share$ ls -la /srv/nfs-share/
total 20
drwxr-xr-x 2 inituser inituser 4096 May  3 12:28 .
drwxr-xr-x 3 root   root    4096 Apr 30 15:48 ..
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-rw-r-- 1 inituser inituser 12 May  3 12:28 server.txt
inituser@nfs-server:/srv/nfs-share$
```

  

```

inituser@hpc1:/mnt/nfs-share$ ls -la /mnt/nfs-share/
total 20
drwxr-xr-x 2 inituser inituser 4096 May  3 12:28 .
drwxr-xr-x 3 root   root    4096 May  3 12:22 ..
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-rw-r-- 1 inituser inituser 12 May  3 12:28 server.txt
inituser@hpc1:/mnt/nfs-share$
```

  

```

inituser@hpc2:/mnt/nfs-share$ ls -la /mnt/nfs-share/
total 20
drwxr-xr-x 2 inituser inituser 4096 May  3 12:28 .
drwxr-xr-x 3 root   root    4096 May  3 12:22 ..
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-rw-r-- 1 inituser inituser 12 May  3 12:28 server.txt
inituser@hpc2:/mnt/nfs-share$
```

[qemu\_vms]0:gemu-system-x86\_64- 1:ssh\_vms\* "nasa-ws3" 20:38 03-May-25

## 第二部分：多使用者帳號與權限控管 (30 pts)

### References

- B12902116 (林靖昀)
- B12902066 (宋和峻)
- <https://kb.symas.com/reference/configure-ldap-client-on-ubuntu>
- <https://askubuntu.com/questions/91598/how-do-i-login-as-root>
- [https://linux.vbird.org/linux\\_server/centos6/0330nfs.php](https://linux.vbird.org/linux_server/centos6/0330nfs.php)

### Explanation

On the server, set up ldap

```
# basic.ldif
dn: olcDatabase={1}mdb,cn=config
changetype: modify
replace: olcSuffix
olcSuffix: dc=nasa,dc=csie,dc=ntu
-
replace: olcRootDN
olcRootDN: cn=admin,dc=nasa,dc=csie,dc=ntu
-
replace: olcRootPW
olcRootPW: {SSHA}8ABxAZ+qNUCbs5pVUmSJMEoYtjBZQQ/J
```

Apply modification

```
ldapmodify -Y EXTERNAL -H ldap:// -f basic.ldif
```

```
# base.ldif
dn: dc=nasa,dc=csie,dc=ntu
dc: nasa
objectClass: top
objectClass: domain

dn: cn=admin,dc=nasa,dc=csie,dc=ntu
cn: admin
objectClass: organizationalRole
description: admin account

dn: ou=people,dc=nasa,dc=csie,dc=ntu
ou: people
objectClass: organizationalUnit

dn: ou=group,dc=nasa,dc=csie,dc=ntu
ou: group
objectClass: organizationalUnit
```

Apply modification

```
ldapadd -D cn=admin,dc=nasa,dc=csie,dc=ntu -W -H ldap:// -f base.ldif
```

```
# group.ldif
dn: cn=student,ou=group,dc=nasa,dc=csie,dc=ntu
objectClass: posixGroup
cn: student
gidNumber: 2000
memberUid: astro1
memberUid: astro2
memberUid: astro3
```

## Apply modifications

```
ldapadd -D cn=admin,dc=nasa,dc=csie,dc=ntu -W -H ldap:// -f group.ldif
```

```
# users.ldif
dn: uid=astro1,ou=people,dc=nasa,dc=csie,dc=ntu
objectClass: inetOrgPerson
objectClass: posixAccount
objectClass: shadowAccount
uid: astro1
sn: astro1
givenName: astro1
cn: astro1
displayName: astro1
uidNumber: 3000
gidNumber: 2000
homeDirectory: /home/astro1
loginShell: /bin/bash
userPassword: {SSHA}L07clmVNcgkpmFUiAmoynch94nC0o3PY

dn: uid=astro2,ou=people,dc=nasa,dc=csie,dc=ntu
objectClass: inetOrgPerson
objectClass: posixAccount
objectClass: shadowAccount
uid: astro2
sn: astro2
givenName: astro2
cn: astro2
displayName: astro2
uidNumber: 3001
gidNumber: 2000
homeDirectory: /home/astro2
loginShell: /bin/bash
userPassword: {SSHA}L07clmVNcgkpmFUiAmoynch94nC0o3PY

dn: uid=astro3,ou=people,dc=nasa,dc=csie,dc=ntu
objectClass: inetOrgPerson
objectClass: posixAccount
objectClass: shadowAccount
uid: astro3
sn: astro3
givenName: astro3
cn: astro3
displayName: astro3
uidNumber: 3002
gidNumber: 2000
homeDirectory: /home/astro3
loginShell: /bin/bash
userPassword: {SSHA}L07clmVNcgkpmFUiAmoynch94nC0o3PY
```

Apply modifications

```
ldapadd -D cn=admin,dc=nasa,dc=csie,dc=ntu -W -H ldapi:/// -f users.ldif
```

On all machines, set up SSSD

```
# /etc/sssd/sssd.conf
[sssd]
config_file_version = 2
services = nss, pam
domains = LDAP

[domain/LDAP]
cache_credentials = true
enumerate = true

id_provider = ldap
auth_provider = ldap

ldap_uri = ldap://192.151.9.13
ldap_search_base = dc=nasa,dc=csie,dc=ntu
chpass_provider = ldap
ldap_chpass_uri = ldap://192.151.9.13
entry_cache_timeout = 600
ldap_network_timeout = 2

# OpenLDAP supports posixGroup, uncomment the following two lines
# to get group membership support (and comment the other conflicting parameters)
ldap_schema = rfc2307
ldap_group_member = memberUid
```

Set permissions

```
chmod 600 /etc/sssd/sssd.conf
```

Edit `/etc/nsswitch.conf` as follows

```
# Begin /etc/nsswitch.conf
```

```
passwd: files sss
```

```
group: files sss
```

```
shadow: files sss
```

```
sudoers: files sss
```

```
publickey: files
```

```
hosts: files dns myhostname
```

```
networks: files
```

```
protocols: files
```

```
services: files
```

```
ethers: files
```

```
rpc: files
```

```
netgroup: files
```

```
# End /etc/nsswitch.conf
```

Edit `/etc/pam.d/system-auth` as follows

```
#%PAM-1.0
```

```
auth sufficient pam_sss.so forward_pass
```

```
auth required pam_unix.so try_first_pass nullok
```

```
auth optional pam_permit.so
```

```
auth required pam_env.so
```

```
account [default=bad success=ok user_unknown=ignore authinfo_unavail=ignore] pam_sss.so
```

```
account required pam_unix.so
```

```
account optional pam_permit.so
```

```
account required pam_time.so
```

```
password sufficient pam_sss.so
```

```
password required pam_unix.so try_first_pass nullok sha512 shadow
```

```
password optional pam_permit.so
```

```
session required pam_mkhomedir.so skel=/etc/skel/ umask=0077
```

```
session required pam_limits.so
```

```
session required pam_unix.so
```

```
session optional pam_sss.so
```

```
session optional pam_permit.so
```

Edit `/etc/pam.d/su` as follows

```
 #%PAM-1.0
auth sufficient pam_rootok.so

auth sufficient pam_sss.so      forward_pass
auth required pam_unix.so

account [default=bad success=ok user_unknown=ignore authinfo_unavail=ignore] pam_sss.so
account required pam_unix.so

session required pam_unix.so
session optional pam_sss.so
```

Configure sudoers

```
# /etc/sudoers.d/student-group
%student ALL=(ALL) ALL
```

Start sssd

```
sudo systemctl enable --now sssd
```

On the clients, unmount

```
sudo umount /mnt/nfs-share
```

On the server, modify `/etc/exports`

```
/srv/nfs-share 192.151.9.14(rw,sync,fsid=0,crossmnt,no_subtree_check,root_squash)
192.151.9.15(rw,sync,fsid=0,crossmnt,no_subtree_check,root_squash)
```

And then execute

```
sudo exportfs -arv
sudo systemctl restart nfs-server
```

Then on the clients, mount again

```
sudo mkdir -p /mnt/nfs-share
sudo mount -t nfs 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

Then on the server, make the directories

```
sudo mkdir -p /srv/nfs-share/astro1_dir
sudo chmod 700 /srv/nfs-share/astro1_dir
sudo chown -R astro1:student /srv/nfs-share/astro1_dir
```

```
sudo mkdir -p /srv/nfs-share/astro2_dir  
sudo chmod 700 /srv/nfs-share/astro2_dir  
sudo chown -R astro2:student /srv/nfs-share/astro2_dir
```

```
sudo mkdir -p /srv/nfs-share/astro3_dir  
sudo chmod 700 /srv/nfs-share/astro3_dir  
sudo chown -R astro3:student /srv/nfs-share/astro3_dir
```

1

The screenshot shows a terminal window with three panes. The top pane displays the command-line interface for creating and managing NFS shares. The middle pane shows the results of running the 'id' command to check user privileges on the server. The bottom pane shows the results of running the 'id' command on a guest VM.

**Top Pane (Terminal):**

```
inituser@nfs-server:/srv/nfs-share$ id astro1  
uid=3000(astro1) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro2  
uid=3001(astro2) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro3  
uid=3002(astro3) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$
```

**Middle Pane (Terminal):**

```
inituser@nfs-server:/srv/nfs-share$ id astro1  
uid=3000(astro1) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro2  
uid=3001(astro2) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro3  
uid=3002(astro3) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$
```

**Bottom Pane (Terminal):**

```
inituser@nfs-server:/srv/nfs-share$ id astro1  
uid=3000(astro1) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro2  
uid=3001(astro2) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$ id astro3  
uid=3002(astro3) gid=2000(student) groups=2000(student)  
inituser@nfs-server:/srv/nfs-share$
```

**Bottom Pane (Guest VM Terminal):**

```
[qemu.vms]0:qemu-system-x86_64- 1:ssh_vms* "nasa-ws3" 22:15 03-May-28
```

2

```
inituser@nfs-server:/srv/nfs-share$ ls -la
total 48
drwxr-xr-x 5 inituser inituser 4096 May  3 14:12 .
drwxr-xr-x 3 root    root   4096 Apr 30 15:48 ..
drwxr--r-- 2 astro1 student 4096 May  3 14:14 astro1_dir
drwxr--r-- 2 astro2 student 4096 May  3 14:12 astro2_dir
drwxr--r-- 2 astro3 student 4096 May  3 14:12 astro3_dir
-rw-rw-r-- 1 inituser inituser 339 May  3 13:04 base.ldif
-rw-rw-r-- 1 inituser inituser 240 May  3 13:04 basic.ldif
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-r--r-- 1 root    root   153 May  3 13:29 group.ldif
-rw-r--r-- 1 inituser inituser 12 May  3 12:28 server.txt
-rw-r--r-- 1 root    root   1087 May  3 13:30 users.ldif
inituser@nfs-server:/srv/nfs-share$
```

  

```
inituser@hpc1:/mnt/nfs-share$ ls -la
total 48
drwxr-xr-x 5 inituser inituser 4096 May  3 14:12 .
drwxr-xr-x 3 root    root   4096 May  3 12:49 ..
drwxr--r-- 2 astro1 student 4096 May  3 14:14 astro1_dir
drwxr--r-- 2 astro2 student 4096 May  3 14:12 astro2_dir
drwxr--r-- 2 astro3 student 4096 May  3 14:12 astro3_dir
-rw-rw-r-- 1 inituser inituser 339 May  3 13:04 base.ldif
-rw-rw-r-- 1 inituser inituser 240 May  3 13:04 basic.ldif
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-r--r-- 1 root    root   153 May  3 13:29 group.ldif
-rw-r--r-- 1 inituser inituser 12 May  3 12:28 server.txt
-rw-r--r-- 1 root    root   1087 May  3 13:30 users.ldif
inituser@hpc1:/mnt/nfs-share$
```

  

```
inituser@hpc2:/mnt/nfs-share$ ls -la
total 48
drwxr-xr-x 5 inituser inituser 4096 May  3 14:12 .
drwxr-xr-x 3 root    root   4096 May  3 12:22 ..
drwxr--r-- 2 astro1 student 4096 May  3 14:14 astro1_dir
drwxr--r-- 2 astro2 student 4096 May  3 14:12 astro2_dir
drwxr--r-- 2 astro3 student 4096 May  3 14:12 astro3_dir
-rw-rw-r-- 1 inituser inituser 339 May  3 13:04 base.ldif
-rw-rw-r-- 1 inituser inituser 240 May  3 13:04 basic.ldif
-rw-rw-r-- 1 inituser inituser 14 May  3 12:24 from_hpc1.txt
-rw-rw-r-- 1 inituser inituser 14 May  3 12:27 from_hpc2.txt
-rw-r--r-- 1 root    root   153 May  3 13:29 group.ldif
-rw-r--r-- 1 inituser inituser 12 May  3 12:28 server.txt
-rw-r--r-- 1 root    root   1087 May  3 13:30 users.ldif
inituser@hpc2:/mnt/nfs-share$
```

[gemu\_vms]0:gemu-system-x86\_64- 1:ssh\_vms\* "nasa-ws3" 22:16 03-May-26

3

```
inituser@nfs-server:/srv/nfs-share$
```

  

```
astro1@hpc1:/$ echo "astro1" > /mnt/nfs-share/astro1_dir/astro1
astro1@hpc1:$
```

  

```
astro2@hpc2:/$ cd /mnt/nfs-share/astro1_dir/
-bash: cd: /mnt/nfs-share/astro1_dir/: Permission denied
astro2@hpc2:$
```

[gemu\_vms]0:gemu-system-x86\_64- 1:ssh\_vms\* "nasa-ws3" 22:28 03-May-26

```
inituser@nfs-server:/srv/nfs-share$ 
astro3@hpc1:~$ cd /mnt/nfs-share/astro1_dir/
-bash: cd: /mnt/nfs-share/astro1_dir/: Permission denied
astro3@hpc1:~$ 

root@hpc2:/mnt/nfs-share# cd /mnt/nfs-share/astro1_dir/
bash: cd: /mnt/nfs-share/astro1_dir/: Permission denied
root@hpc2:/mnt/nfs-share# 

[gemu_vms]0:gemu-system-x86_64-1:ssh_vms* "nasa-ws3" 22:21 03-May-26
```

## 第三部分：效能與大規模檔案測試 (40 pts)

### References

- B12902116 (林靖昀)
- B12902066 (宋和峻)
- <https://www.man7.org/linux/man-pages/man1/uptime.1.html>
- [https://blog.csdn.net/tiantianhaoxinqing\\_\\_/article/details/125956299?fbclid=IwZXh0bgNhZW0CMTEAAR7GiAOx4YAeaOP21aE9ZL8iuC7HO2WtPL8kgUK\\_QoS7Ha7YVJzyM8dOKr3mow\\_aem\\_FbHiktXJoCFzE5A0ynZByg](https://blog.csdn.net/tiantianhaoxinqing__/article/details/125956299?fbclid=IwZXh0bgNhZW0CMTEAAR7GiAOx4YAeaOP21aE9ZL8iuC7HO2WtPL8kgUK_QoS7Ha7YVJzyM8dOKr3mow_aem_FbHiktXJoCFzE5A0ynZByg)
- <https://unix.stackexchange.com/questions/218074/how-to-know-number-of-cores-of-a-system-in-linux>

### NFS settings

For each experiment, on the clients, unmount

```
sudo umount /mnt/nfs-share
```

For A and B, modify `/etc/exports`

```
/srv/nfs-share 192.151.9.14(rw,sync,fsid=0,crossmnt,no_subtree_check,root_squash)
192.151.9.15(rw,sync,fsid=0,crossmnt,no_subtree_check,root_squash)
```

For C and D, modify `/etc/exports`

```
/srv/nfs-share 192.151.9.14(rw,async,fsid=0,crossmnt,no_subtree_check,root_squash)  
192.151.9.15(rw,async,fsid=0,crossmnt,no_subtree_check,root_squash)
```

And then execute

```
sudo exportfs -arv  
sudo systemctl restart nfs-server
```

Then on the clients, mount again

For A

```
sudo mkdir -p /mnt/nfs-share  
sudo mount -t nfs -o sync,rsize=8192,wsize=8192 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

For B

```
sudo mkdir -p /mnt/nfs-share  
sudo mount -t nfs -o sync,rsize=32768,wsize=32768 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

For C

```
sudo mkdir -p /mnt/nfs-share  
sudo mount -t nfs -o async,rsize=8192,wsize=8192 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

For D

```
sudo mkdir -p /mnt/nfs-share  
sudo mount -t nfs -o async,rsize=32768,wsize=32768 192.151.9.13:/srv/nfs-share /mnt/nfs-share
```

## Shell Script

On the server,

```

#!/bin/bash
# nfs_test_b12902118.sh
sudo -v

MOUNT_POINT="/mnt/nfs-share"
TESTFILE="$MOUNT_POINT/$(whoami)_dir/$(hostname)"
RESULT_FILE="$MOUNT_POINT/$(whoami)_dir/nfs_test_result_${hostname}_$(date +%s).txt"

# Function to monitor vmstat during a test and compute averages
monitor_vmstat() {
    local duration_pid=$1
    local log_file=$2

    sleep 0.1
    vmstat 1 > "$log_file" &
    local vm_pid=$!

    wait "$duration_pid"
    kill "$vm_pid" 2>/dev/null
    wait "$vm_pid" 2>/dev/null
}

# Function to extract average CPU usage and load from vmstat log
parse_vmstat_avg() {
    local log_file=$1

    awk '
NR > 2 {
    load_sum += $1;
    us_sum += $13;
    sy_sum += $14;
    count++;
}
END {
    if (count > 0) {
        printf "%.2f\n", (us_sum + sy_sum) / count;
        printf "%.2f\n", load_sum / count;
    } else {
        print "No data collected from vmstat.";
    }
}' "$log_file"
}

# Function to extract time and speed from dd output
parse_dd_output() {
    local output="$1"
    echo "$output" | grep -Eo '[0-9\.]+ s, [0-9\.]+ MB/s' | awk -F'[ ,]+'{printf "%s\n%s\n", $1, $3}
}

```

```

# --- Write Test ---

WRITE_VMSTAT_LOG="/tmp/vmstat_write_${whoami}_${hostname}.log"
WRITE_DD_LOG="/tmp/dd_write_${whoami}_${hostname}.log"
(dd if=/dev/zero of="$TESTFILE" bs=1M count=1000 conv=fdatasync) &>"$WRITE_DD_LOG" &
WRITE_PID=$!
monitor_vmstat "$WRITE_PID" "$WRITE_VMSTAT_LOG"
wait "$WRITE_PID"

parse_dd_output "$(cat "$WRITE_DD_LOG")" | tee -a "$RESULT_FILE"
parse_vmstat_avg "$WRITE_VMSTAT_LOG" | tee -a "$RESULT_FILE"

# Clear cache
sync; echo 3 | sudo tee /proc/sys/vm/drop_caches > /dev/null

# --- Read Test ---

READ_VMSTAT_LOG="/tmp/vmstat_read_${whoami}_${hostname}.log"
READ_DD_LOG="/tmp/dd_read_${whoami}_${hostname}.log"
(dd if="$TESTFILE" of=/dev/null bs=1M count=1000) &>"$READ_DD_LOG" &
READ_PID=$!
monitor_vmstat "$READ_PID" "$READ_VMSTAT_LOG"
wait "$READ_PID"

parse_dd_output "$(cat "$READ_DD_LOG")" | tee -a "$RESULT_FILE"
parse_vmstat_avg "$READ_VMSTAT_LOG" | tee -a "$RESULT_FILE"

# Cleanup
rm -f "$TESTFILE"

```

Set permissions

```

sudo chmod 755 /srv/nfs-share/nfs_test_b12902118.sh
sudo chown root:root /srv/nfs-share/nfs_test_b12902118.sh

```

This script writes and reads a 1GB file at the nfs mounted directory and uses `dd` to measure the writing and reading times and rates. `vmstat` is used to get the average CPU usage and load. This script does writing, clearing cache, and then reading.

## Results

測試情境	寫入時間 (s)	寫入平均傳輸速率 (MB/s)	寫入CPU 使用率 / 負載	讀取時間 (s)	讀取平均傳輸速率 (MB/s)	讀取CPU 使用率 / 負載
參數組合 A + 單一使用者	146.4990	7.20	20.41% / 0.38	21.2678	49.30	78.08% / 1.79
參數組合 A + 多使用者	400.2010	2.60	20.13% / 0.39	61.0795	17.18	79.56% / 2.19
參數組合 B + 單一使用者	125.2540	8.40	9.87% / 0.32	18.7597	55.90	83.05% / 1.53
參數組合 B + 多使用者	406.3197	2.60	11.06% / 0.21	40.8599	25.67	83.75% / 2.33
參數組合 C + 單一使用者	15.1003	69.40	69.4% / 1.93	15.1153	69.40	83.80% / 2.27
參數組合 C + 多使用者	73.2524	17.41	46.53% / 1.09	55.90	18.77	80.31% / 2.52
參數組合 D + 單一使用者	14.6719	71.50	59.60% / 1.07	19.9957	52.40	83.65% / 1.45
參數組合 D + 多使用者	86.6193	15.35	56.03% / 0.6417	60.9878	17.28	76.73% / 1.68

## Answer

Yes, there is an efficiency degrade. I think the reason is because in the multi-user setting, NFS needs to deal with with syncing, all writing requests from clients need to be synchronized, causing overhead. We can adjust server side syncing option to async to improve performance.