

NASA HW2

NA

IPerf3

```
1 iperf3 -s # server
2 iperf3 -n 100M -c 192.168.88.196 # client
```

```
Server listening on 5201 (test #1)
-----
Accepted connection from 192.168.88.194, port 41044
[ 5] local 192.168.88.196 port 5201 connected to 192.168.88.194 port 41046
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-1.00    sec  22.3 MBytes  187 Mb/s
[ 5]  1.00-2.00    sec  22.5 MBytes  189 Mb/s
[ 5]  2.00-3.00    sec  20.0 MBytes  167 Mb/s
[ 5]  3.00-4.00    sec  24.6 MBytes  206 Mb/s
[ 5]  4.00-4.32    sec   8.35 MBytes  220 Mb/s
-----
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-4.32    sec  97.6 MBytes  190 Mb/s
-----
Server listening on 5201 (test #2)
-----
Accepted connection from 192.168.88.194, port 41048
[ 5] local 192.168.88.196 port 5201 connected to 192.168.88.194 port 41050
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-1.00    sec  14.1 MBytes  118 Mb/s
[ 5]  1.00-2.00    sec  15.4 MBytes  129 Mb/s
[ 5]  2.00-3.00    sec  20.6 MBytes  173 Mb/s
[ 5]  3.00-4.00    sec  21.1 MBytes  177 Mb/s
[ 5]  4.00-5.00    sec  21.2 MBytes  177 Mb/s
[ 5]  5.00-5.26    sec   5.41 MBytes  178 Mb/s
-----
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-5.26    sec  97.7 MBytes  156 Mb/s
-----
Server listening on 5201 (test #3)
-----
Accepted connection from 192.168.88.194, port 41054
[ 5] local 192.168.88.196 port 5201 connected to 192.168.88.194 port 41056
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-1.00    sec   5.79 MBytes  48.6 Mb/s
[ 5]  1.00-2.00    sec   6.11 MBytes  51.2 Mb/s
[ 5]  2.00-3.00    sec   4.21 MBytes  35.4 Mb/s
[ 5]  3.00-4.00    sec   5.15 MBytes  43.2 Mb/s
[ 5]  4.00-5.00    sec   5.92 MBytes  49.6 Mb/s
[ 5]  5.00-6.00    sec   5.05 MBytes  42.4 Mb/s
[ 5]  6.00-7.00    sec   5.74 MBytes  48.2 Mb/s
[ 5]  7.00-8.00    sec   6.20 MBytes  52.0 Mb/s
[ 5]  8.00-9.00    sec   6.40 MBytes  53.5 Mb/s
[ 5]  9.00-10.00   sec   5.17 MBytes  43.5 Mb/s
[ 5] 10.00-11.00   sec   6.44 MBytes  54.1 Mb/s
[ 5] 11.00-12.00   sec   5.66 MBytes  47.5 Mb/s
[ 5] 12.00-13.00   sec   5.93 MBytes  49.7 Mb/s
[ 5] 13.00-14.00   sec   4.93 MBytes  41.4 Mb/s
[ 5] 14.00-15.00   sec   5.32 MBytes  44.7 Mb/s
[ 5] 15.00-16.00   sec   3.75 MBytes  31.4 Mb/s
[ 5] 16.00-17.00   sec   5.57 MBytes  46.7 Mb/s
[ 5] 17.00-17.98   sec   5.14 MBytes  44.2 Mb/s
-----
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-17.98   sec  98.5 MBytes  46.0 Mb/s
-----
receiver
```

nc with ipv6: man nc

make ssh tunnel: <https://ma.ttias.be/socks-proxy-linux-ssh-bypass-content-filters/>

nc with proxy and ipv6: man nc

mac address to EUI-64: <https://eui64-calc.princelle.org/>

IPv6

先nc發現沒DNS紀錄:

```
1 | nc -6 oasis1.csie.ntu.edu.tw 8888
```

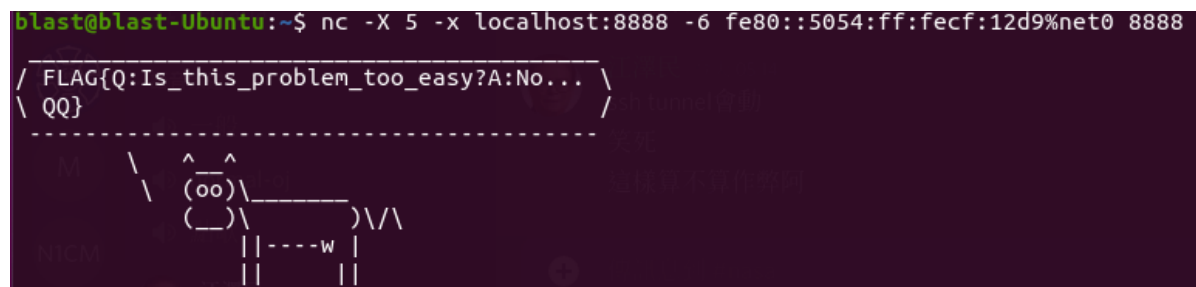
既然是ipv6那肯定就是link-local address，去linux7上面ping oasis1，然後把arp撈出來以此得知oasis1的mac address:

```
1 | ping oasis1.csie.ntu.edu.tw
2 | arp -a # oasis1.csie.ntu.edu.tw (140.112.30.51) at 52:54:00:cf:12:d9 [ether]
   on net0
```

然後在去網路上找工具把mac address 轉成eui-64，可以得知oasis1.csie.ntu.edu.tw的link-local address是fe80::5054:ff:fecf:12d9，

因此在本地端搭建一個ssh tunnel(socks5)到linux7，再把nc命令轉發過到linux7上就好

```
1 | ssh -C -f -N -D 1234 40947047s@linux7.csie.ntu.edu.tw -p 22 #make ssh tunnel
   on local with 8888 port
2 | nc -X 5 -x localhost:1234 -6 fe80::5054:ff:fecf:12d9%net0 8888 #nc with proxy
```



```
blast@blast-Ubuntu:~$ nc -X 5 -x localhost:8888 -6 fe80::5054:ff:fecf:12d9%net0 8888
/ FLAG{Q:Is_this_problem_too_easy?A:No... \
\ QQ}
-----
      \      ^__^
       (oo)\_____)
          (_____)
             ||----w |
             ||     ||
I am a hacker
I am a hacker
```

vlan tag: <https://weihanit.wordpress.com/2017/07/27/switch%E4%B8%9E%E7%A8%AEport%E6%A8%A1%E5%BC%8Faccess%E3%80%81hybrid%E3%80%81trunk%E8%A1%8C%E7%82%BA%E6%A8%A1%E5%BC%8F/>

link aggregation: <https://www.jannet.hk/etherchannel-pagp-lacp-zh-hant/>

Cisco Switch

1. VLAN, Access, and Trunk

- 3是access mode, 所以header會塞上唯一一個vlan ID(307)並傳出去
4是trunk, 但是沒有指定native vlan,所以 header會塞default native vlan(vlan 1)並傳出去
5是trunk, 有指定native vlan, 所以 header會塞native vlan(vlan 307)並傳出去
- 通過之前帶有header並包含tag(424), 通過之後由於是untagged port, 所以header會被整個拿掉
- 假設switch A上的vlan 20包含了很多port,switch B上的vlan 21也包含了很多port, 我們某天如果想要讓vlan 20跟21互通, 但由於上面port過多不想改設定(兩個都改成20 or 21), 我們可以把switch A上的與B相連的port的Native VLAN設為vlan 20, switch B上與A相連的port的Native VLAN設定成vlan 21, 這樣從20出去的untagged封包(vlan 20)到switch B上就會被forward成21, 達到相連的效果

2. More on Link Aggregation

- 不行, Link Aggregation是將多個物理網卡合成一個邏輯網卡, 在系統裡面只會看到一張網卡, 如果物理網卡速度不一樣, 有可能導致某條物理網卡傳送過多的封包進而導致阻塞
- Gi1 /0/1, Gi1 /0/2兩個都是passive mode, 整個channel無法搭建, Link aggregation沒有成功, 修正方法是對Gi1 /0/1下

```
1 | channel-group 1 mode active
```

3. Network Debugging

- 因為NewUser的Privilege 為2, 該機器上的設定privilege 2 只有show跟show running-config, 沒有conf t的權限
- TopSecret**
- 一開始發現兩個port shutdown了, 先拉起, 接著又看到兩個Link Aggregation模式都是passive(應該要是active), 也順便改一下

```
1 | int GigabitEthernet1/0/2
2 | no shutdown
3 | channel-group 1 mode active
4 | int GigabitEthernet1/0/3
5 | no shutdown
6 | channel-group 1 mode active
```

到這時候好像還是不會動, 讓它跑一次simulation, 報的錯誤是兩個vlan(100, 200)沒有啟動, 打開就會動了

```
1 | vlan 100
2 | vlan 200
```

NTFS Mount: <https://unix.stackexchange.com/questions/511872/what-is-the-correct-permission-in-etc-fstab-to-mount-ntfs>

1. 與其他作業系統共用檔案

```
1 sudo mkfs.ntfs /dev/sdi1 #Make NTFS file system
2 sudo blkid # Get UUID of /dev/sdi1, in my case is 569BD5B5536991D9
3 sudo sh -c "echo 'UUID=569BD5B5536991D9 /mnt/usbdisk ntfs3
   rw,auto,user,fmask=133,dmask=022,uid=1000,gid=1000 0 0' >> /etc/fstab" #
   write mounting information to fstab
```

```
nasahw2 login: nasa
Password:
Last login: Wed Mar 16 06:17:52 on tty1
Inasa@nasahw2 ~1$ lsblk; df -hT
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINTS
sda	8:0	0	5G	0	disk	
l-sda1	8:1	0	128M	0	part	/boot
l-sda2	8:2	0	4.9G	0	part	/
sdb	8:16	0	1G	0	disk	
l-sdb1	8:17	0	1023M	0	part	
l-NasaHW2-course	254:0	0	1G	0	lum	/home/nasa/course
sdc	8:32	0	1G	0	disk	
l-sdc1	8:33	0	1023M	0	part	
l-NasaHW2-course	254:0	0	1G	0	lum	/home/nasa/course
l-NasaHW2-homework	254:1	0	800M	0	lum	
l-homework	254:2	0	784M	0	crypt	/home/nasa/homework
sdd	8:48	0	1G	0	disk	
l-sdd1	8:49	0	1023M	0	part	
sde	8:64	0	1G	0	disk	
l-sde1	8:65	0	1014M	0	part	
l-sde9	8:73	0	8M	0	part	
sdf	8:80	0	1G	0	disk	
l-sdf1	8:81	0	1014M	0	part	
l-sdf9	8:89	0	8M	0	part	
sdg	8:96	0	1G	0	disk	
l-sdg1	8:97	0	1014M	0	part	
l-sdg9	8:105	0	8M	0	part	
sdh	8:112	0	1G	0	disk	
l-sdh1	8:113	0	1014M	0	part	
l-sdh9	8:121	0	8M	0	part	
sdi	8:128	0	8G	0	disk	
l-sdi1	8:129	0	8G	0	part	/mnt/usbdisk

```
Filesystem                                Type      Size  Used Avail Use% Mounted on
dev                                         devtmpfs  2.0G   0    2.0G   0% /dev
run                                         tmpfs     2.0G  788K   2.0G   1% /run
/dev/sda2                                  ext4       4.8G  2.8G   1.8G  62% /
tmpfs                                       tmpfs     2.0G   0    2.0G   0% /dev/shm
tmpfs                                       tmpfs     2.0G   0    2.0G   0% /tmp
/dev/sda1                                  vfat       128M   51M    78M  40% /boot
/dev/mapper/NasaHW2-course                 ext4       983M   34M   900M   4% /home/nasa/course
/dev/sdi1                                  ntfs3      8.0G   42M   8.0G   1% /mnt/usbdisk
/dev/mapper/homework                      ext4       755M   24K   700M   1% /home/nasa/homework
NTNU_40947047s                            zfs        2.7G  128K   2.7G   1% /mnt/zfs
tmpfs                                       tmpfs     100K   0    100K   0% /var/lib/ldx/shmounts
tmpfs                                       tmpfs     100K   0    100K   0% /var/lib/ldx/devlxd
tmpfs                                       tmpfs     392M   0    392M   0% /run/user/1000
Inasa@nasahw2 ~1$
```

2. 記憶體不足？

```
1 sudo fallocate -l 1G /myswap # Make swap
file
2 sudo chmod 600 /myswap # Set
permission
3 sudo mkswap /myswap # Make swap
4 sudo swapon /myswap # Open swap
5 sudo sh -c "echo '/myswap swap swap defaults 0 0' >> /etc/fstab" # Write
Mount Message to fstab
```

```
linux7.csie.ntu.edu.tw:5910 x
[nasa@nasahw2 ~]$ free -h
              total        used        free      shared  buff/cache   available
Mem:           3.8Gi        175Mi        3.5Gi         2.0Mi         166Mi        3.5Gi
Swap:          1.0Gi           0B          1.0Gi
[nasa@nasahw2 ~]$
```

3. 空間不足

```
1 sudo lvextend -L1G /dev/NasaHW2/course
2 sudo resize2fs /dev/NasaHW2/course
```

```
[nasa@nasahw2 ~]$ lsblk; df -hT
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sda          8:0    0    5G  0 disk
├─sda1       8:1    0  128M  0 part /boot
└─sda2       8:2    0   4.9G  0 part /
sdb          8:16   0    1G  0 disk
└─sdb1       8:17   0  1023M  0 part
   └─NasaHW2-course 254:0    0    1G  0 lvm  /home/nasa/course
sdc          8:32   0    1G  0 disk
└─sdc1       8:33   0  1023M  0 part
   └─NasaHW2-course 254:0    0    1G  0 lvm  /home/nasa/course
sdd          8:48   0    1G  0 disk
└─sdd1       8:49   0  1023M  0 part
sde          8:64   0    1G  0 disk
sdf          8:80   0    1G  0 disk
sdg          8:96   0    1G  0 disk
sdh          8:112  0    1G  0 disk
sdi          8:128  0    8G  0 disk
└─sdi1       8:129  0    8G  0 part /mnt/usbdisk
Filesystem      Type      Size  Used Avail Use% Mounted on
dev             devtmpfs  2.0G   0    2.0G   0% /dev
run             tmpfs     2.0G  736K  2.0G   1% /run
/dev/sda2       ext4      4.8G  2.8G  1.8G  62% /
tmpfs           tmpfs     2.0G   0    2.0G   0% /dev/shm
tmpfs           tmpfs     2.0G   0    2.0G   0% /tmp
/dev/sda1       vfat      128M   51M   78M  40% /boot
/dev/mapper/NasaHW2-course ext4      953M   3.3M  900M   1% /home/nasa/course
/dev/sdi1       fuseblk   8.0G   42M   8.0G   1% /mnt/usbdisk
tmpfs           tmpfs     100K   0    100K   0% /var/lib/xd/shmounts
tmpfs           tmpfs     100K   0    100K   0% /var/lib/xd/dev/xd
tmpfs           tmpfs     392M   0    392M   0% /run/user/1000
[nasa@nasahw2 ~]$
```

Create luksLvm: <https://gist.github.com/huynhvn/1109822a989914ecb730383fa0f9cfad>

Auto decrypt and auto mount: <https://www.howtoforge.com/automatically-unlock-luks-encrypted-drives-with-a-keyfile>

4. 建立加密分割區

```
1 sudo lvcreate -n homework -L 800M NasaHW2
2 sudo sh -c "echo 'YES' | cryptsetup luksFormat /dev/mapper/NasaHW2-homework
  --key-file /home/nasa/lvm_key"
3 sudo cryptsetup luksOpen /dev/mapper/NasaHW2-homework homework --key-file
  /home/nasa/lvm_key
4 sudo mkfs.ext4 /dev/mapper/homework
5 sudo vim /etc/crypttab #auto decrypt
6 # Append this to the end of file
7 homework /dev/mapper/NasaHW2-homework /home/nasa/lvm_key luks
8 sudo vim /etc/fstab #auto mount
9 # Append this to the end of file
10 /dev/mapper/homework /home/nasa/homework ext4 defaults 0 2
11 sudo reboot
```

```
[nasa@nasahw2 ~]$ lsblk;df -hT
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINTS
sda	8:0	0	5G	0	disk	
l-sda1	8:1	0	128M	0	part	/boot
`-sda2	8:2	0	4.9G	0	part	/
sdb	8:16	0	1G	0	disk	
`-sdb1	8:17	0	1023M	0	part	
`-NasaHW2-course	254:0	0	1G	0	lvm	/home/nasa/course
sdc	8:32	0	1G	0	disk	
`-sdc1	8:33	0	1023M	0	part	
l-NasaHW2-course	254:0	0	1G	0	lvm	/home/nasa/course
`-NasaHW2-homework	254:1	0	800M	0	lvm	
`-homework	254:2	0	784M	0	crypt	/home/nasa/homework
sdd	8:48	0	1G	0	disk	
`-sdd1	8:49	0	1023M	0	part	
sde	8:64	0	1G	0	disk	
sdf	8:80	0	1G	0	disk	
sdg	8:96	0	1G	0	disk	
sdh	8:112	0	1G	0	disk	
sdi	8:128	0	8G	0	disk	
`-sdi1	8:129	0	8G	0	part	/mnt/usbdisk

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
dev	devtmpfs	2.0G	0	2.0G	0%	/dev
run	tmpfs	2.0G	752K	2.0G	1%	/run
/dev/sda2	ext4	4.8G	2.8G	1.8G	62%	/
tmpfs	tmpfs	2.0G	0	2.0G	0%	/dev/shm
tmpfs	tmpfs	2.0G	0	2.0G	0%	/tmp
/dev/sda1	ufat	128M	51M	78M	40%	/boot
/dev/mapper/NasaHW2-course	ext4	983M	34M	900M	4%	/home/nasa/course
/dev/sdi1	fuseblk	8.0G	42M	8.0G	1%	/mnt/usbdisk
/dev/mapper/homework	ext4	755M	24K	700M	1%	/home/nasa/homework
tmpfs	tmpfs	100K	0	100K	0%	/var/lib/xd/shmounts
tmpfs	tmpfs	100K	0	100K	0%	/var/lib/xd/devlxd
tmpfs	tmpfs	392M	0	392M	0%	/run/user/1000

```
[nasa@nasahw2 ~]$
```

Create backup of lvm: <https://devconnected.com/lvm-snapshots-backup-and-restore-on-linux/>

Compress zst using tar: <https://askubuntu.com/questions/834717/recursive-tar-compression>

5. Extend then Snapshot

```
1 | sudo vgextend NasaHW2 /dev/sdd1
2 | sudo lvcreate -s -n backup -L 500M /dev/mapper/NasaHW2-course
3 | sudo mkdir /mnt/backup
4 | sudo mount /dev/mapper/NasaHW2-backup /mnt/backup
5 | sudo tar -cavf /home/nasa/backup.tar.zst /mnt/backup
6 | sudo umount /mnt/backup
7 | sudo lvremove NasaHW2/backup
8 | sudo rm /mnt/backup
```

```
[nasa@nasahw2 ~]$ lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
sda                                 8:0    0    5G  0 disk
├─sda1                             8:1    0  128M  0 part  /boot
└─sda2                             8:2    0   4.9G  0 part  /
sdb                                 8:16   0    1G  0 disk
├─sdb1                             8:17   0  1023M  0 part
│   └─NasaHW2-course-real          254:3    0    1G  0 lvm
│       ├─NasaHW2-course           254:0    0    1G  0 lvm  /home/nasa/course
│       └─NasaHW2-backup           254:5    0    1G  0 lvm  /mnt/backup
sdc                                 8:32   0    1G  0 disk
├─sdc1                             8:33   0  1023M  0 part
│   ├─NasaHW2-homework            254:1    0   800M  0 lvm
│   │   └─homework                254:2    0   784M  0 crypt /home/nasa/homework
│   └─NasaHW2-course-real          254:3    0    1G  0 lvm
│       ├─NasaHW2-course           254:0    0    1G  0 lvm  /home/nasa/course
│       └─NasaHW2-backup           254:5    0    1G  0 lvm  /mnt/backup
sdd                                 8:48   0    1G  0 disk
├─sdd1                             8:49   0  1023M  0 part
│   └─NasaHW2-backup-cow          254:4    0   500M  0 lvm
│       └─NasaHW2-backup           254:5    0    1G  0 lvm  /mnt/backup
sde                                 8:64   0    1G  0 disk
sdf                                 8:80   0    1G  0 disk
sdg                                 8:96   0    1G  0 disk
sdh                                 8:112  0    1G  0 disk
sdi                                 8:128  0    8G  0 disk
└─sdi1                             8:129  0    8G  0 part  /mnt/usbdisk
[nasa@nasahw2 ~]$ _
```

Create zpool: <https://docs.oracle.com/cd/E19253-01/819-5461/gcvjg/index.html>

Set mountpoint of zfs: <https://docs.oracle.com/cd/E19253-01/819-5461/gaynd/index.html>

6. Now, Start using ZFS

```
1 | sudo zpool create NTNU_40947047s raidz /dev/sde /dev/sdf /dev/sdg /dev/sdh
2 | sudo zfs set mountpoint=/mnt/zfs NTNU_40947047s
```

```
[nasa@nasahw2 ~]# sudo zpool status; df -h
```

```
pool: NTNU_40947047s
```

```
state: ONLINE
```

```
config:
```

NAME	STATE	READ	WRITE	CKSUM
NTNU_40947047s	ONLINE	0	0	0
raidz1-0	ONLINE	0	0	0
sde	ONLINE	0	0	0
sdf	ONLINE	0	0	0
sdg	ONLINE	0	0	0
sdh	ONLINE	0	0	0

```
errors: No known data errors
```

Filesystem	Size	Used	Avail	Use%	Mounted on
dev	2.0G	0	2.0G	0%	/dev
run	2.0G	796K	2.0G	1%	/run
/dev/sda2	4.8G	2.8G	1.8G	62%	/
tmpfs	2.0G	0	2.0G	0%	/dev/shm
tmpfs	2.0G	0	2.0G	0%	/tmp
/dev/sda1	128M	51M	78M	40%	/boot
/dev/mapper/NasaHW2-course	983M	34M	900M	4%	/home/nasa/course
/dev/sdi1	8.0G	42M	8.0G	1%	/mnt/usbdisk
/dev/mapper/homework	755M	24K	700M	1%	/home/nasa/homework
tmpfs	100K	0	100K	0%	/var/lib/lxd/shmounts
tmpfs	100K	0	100K	0%	/var/lib/lxd/devlxd
tmpfs	392M	0	392M	0%	/run/user/1000
NTNU_40947047s	2.7G	128K	2.7G	1%	/mnt/zfs

```
[nasa@nasahw2 ~]#
```


Create encrypted zfs dataset and auto decrypt: <https://wiki.archlinux.org/title/ZFS>

Set properties of zfs: <https://docs.freebsd.org/en/books/handbook/zfs/>

7. Create ZFS Dataset

```
1 sudo zfs create -o encryption=on -o keyformat=raw -o
  keylocation=file:///home/nasa/zfs_key NTNU_40947047s/httpcat
2 sudo zfs set copies=2 NTNU_40947047s/httpcat
3 sudo zfs set quota=500M NTNU_40947047s/httpcat
4 sudo zfs set mountpoint=/home/nasa/httpcat NTNU_40947047s/httpcat
5 sudo vim /etc/systemd/system/zfs-load-key@.service
6 #Add this to /etc/systemd/system/zfs-load-key@.service
7 [Unit]
8 Description=Load %I encryption keys
9 Before=systemd-user-sessions.service
10 After=zfs-import.target
11
12 [Service]
13 Type=oneshot
14 RemainAfterExit=yes
15 ExecStart=/usr/bin/bash -c "zfs load-key %I; zfs mount %I"
16 Screenshot from 2022-03-14 05-59-01
17 [Install]
18 WantedBy=zfs-mount.service
19
20 sudo systemctl enable zfs-load-key@NTNU_40947047s-httpcat.service
21 sudo zfs mount NTNU_40947047s/httpcat
22 sudo cp /home/nasa/imgs/http_cat/* /home/nasa/httpcat
23 sudo reboot
```

```
[nasa@nasahw2 ~]$ ls -l /home/nasa/httpcat; df -h
total 824
-rw-r--r-- 1 root root 27012 Mar 14 05:47 http_cat_200.jpg
-rw-r--r-- 1 root root 43124 Mar 14 05:47 http_cat_301.jpg
-rw-r--r-- 1 root root 43408 Mar 14 05:47 http_cat_302.jpg
-rw-r--r-- 1 root root 62251 Mar 14 05:47 http_cat_304.jpg
-rw-r--r-- 1 root root 79163 Mar 14 05:47 http_cat_404.jpg
-rw-r--r-- 1 root root 30814 Mar 14 05:47 http_cat_405.jpg
-rw-r--r-- 1 root root 26913 Mar 14 05:47 http_cat_418.jpg
-rw-r--r-- 1 root root 46496 Mar 14 05:47 http_cat_500.jpg
-rw-r--r-- 1 root root 55606 Mar 14 05:47 http_cat_504.jpg
Filesystem      Size  Used Avail Use% Mounted on
dev             2.0G   0    2.0G   0% /dev
run             2.0G 796K   2.0G   1% /run
/dev/sda2       4.8G  2.8G   1.8G  62% /
tmpfs           2.0G   0    2.0G   0% /dev/shm
tmpfs           2.0G   0    2.0G   0% /tmp
/dev/sda1       128M   51M   78M  40% /boot
/dev/mapper/NasaHW2-course 983M  34M  900M   4% /home/nasa/course
/dev/sdi1       8.0G  42M   8.0G   1% /mnt/usbdisk
/dev/mapper/homework 755M  24K  700M   1% /home/nasa/homework
NTNU_40947047s  2.7G 128K  2.7G   1% /mnt/zfs
NTNU_40947047s/httpcat 500M  1.0M  499M   1% /home/nasa/httpcat
tmpfs           100K   0   100K   0% /var/lib/ldx/shmounts
tmpfs           100K   0   100K   0% /var/lib/ldx/devldx
tmpfs           392M   0   392M   0% /run/user/1000
[nasa@nasahw2 ~]$
```

Create ZVOL: <https://wiki.debian.org/ZFS>

Create Snapshot: <https://docs.oracle.com/cd/E19253-01/819-5461/gbcya/index.html>

8. Create ext4 on ZFS?

```
1 | sudo zfs create -s -o compression=lz4 -V 250M NTNU_40S947047s/Test
2 | sudo mkfs.ext4 /dev/zvol/NTNU_40947047s/Test
3 | sudo mount /dev/zvol/NTNU_40947047s/Test /home/nasa/test
```

```
[nasa@nasahw2 ~]# df -H
Filesystem                Size      Used Avail Use% Mounted on
dev                      2.1G         0  2.1G   0% /dev
run                      2.1G    816k  2.1G   1% /run
/dev/sda2                5.1G    3.0G  1.9G  62% /
tmpfs                   2.1G         0  2.1G   0% /dev/shm
tmpfs                   2.1G         0  2.1G   0% /tmp
/dev/sda1               134M     53M   82M  40% /boot
/dev/mapper/NasaHW2-course 1.1G     36M  943M   4% /home/nasa/course
/dev/sd11                8.6G     44M  8.6G   1% /mnt/usbdisk
/dev/mapper/homework      791M     25k  734M   1% /home/nasa/homework
NTNU_40947047s          2.9G   525k  2.9G   1% /mnt/zfs
tmpfs                   103k         0  103k   0% /var/lib/xd/shmounts
tmpfs                   103k         0  103k   0% /var/lib/xd/dev/xd
tmpfs                   411M         0  411M   0% /run/user/1000
/dev/zd0                240M     15k  223M   1% /home/nasa/test
[nasa@nasahw2 ~]# _
```

當我們想要把zpool弄成一個swap分區的時候，因為swap是一種file system, 因此我們便需要zvol

9. ZFS Snapshot

```
1 | sudo zfs snapshot -r NTNU_40947047s/httpcat@before
2 | sudo curl https://http.cat/202.jpg -o /home/nasa/httpcat/202.jpg
3 | sudo zfs snapshot -r NTNU_40947047s/httpcat@after
```

```
[nasa@nasahw2 ~]# zfs list -rt all NTNU_40947047s/httpcat ; sudo zfs diff NTNU_40947047s/httpcat@before
NAME                                USED    AVAIL    REFER  MOUNTPOINT
NTNU_40947047s/httpcat             1.13M   499M    1.03M  /home/nasa/httpcat
NTNU_40947047s/httpcat@before      100K    -        934K  -
NTNU_40947047s/httpcat@after        0B     -        1.03M  -
+      /home/nasa/httpcat/202.jpg
M      /home/nasa/httpcat/
```

10. Rollback Snapshot

```
1 | sudo zfs rollback -r NTNU_40947047s/httpcat@before
```

```
[nasa@nasahw2 ~]$ zfs list -rt all NTNU_40947047s/httpcat ; ls -l /home/nasa/httpcat/
NAME                                USED  AVAIL  REFER  MOUNTPOINT
NTNU_40947047s/httpcat              934K  499M   934K   /home/nasa/httpcat
NTNU_40947047s/httpcat@before        0B    -     934K   -
total 824
-rw-r--r--  1 root root 27012 Mar 14 05:47 http_cat_200.jpg
-rw-r--r--  1 root root 43124 Mar 14 05:47 http_cat_301.jpg
-rw-r--r--  1 root root 43408 Mar 14 05:47 http_cat_302.jpg
-rw-r--r--  1 root root 62251 Mar 14 05:47 http_cat_304.jpg
-rw-r--r--  1 root root 79163 Mar 14 05:47 http_cat_404.jpg
-rw-r--r--  1 root root 30814 Mar 14 05:47 http_cat_405.jpg
-rw-r--r--  1 root root 26913 Mar 14 05:47 http_cat_418.jpg
-rw-r--r--  1 root root 46496 Mar 14 05:47 http_cat_500.jpg
-rw-r--r--  1 root root 55606 Mar 14 05:47 http_cat_504.jpg
[nasa@nasahw2 ~]$ _
```

11. Short Answer

1. Ext4是日誌式檔案系統，可以處理寫入中斷，ZFS則是支援邏輯磁區管理(類似LVM但沒有大小只有Quota)。
2. RAID 0: 檔案分塊存到不同地方，用併行的方式處理讀取，以達到加速的效果。
RAID 1: 以鏡像的方式在兩個磁區儲存兩份一樣得檔案，這樣就可以達到備份的效果。
RAID 5: 需要N+1個磁盤，以XOR的方式，把N個的內容XOR到剩下的磁盤，只要N+1個磁盤壞掉兩個以下，就可以XOR回去得到原本的資料。
RAID 10: 需要4*N個磁盤，會得到2*N的空間，先兩兩組成一套RAID 0，在把兩套組成RAID 1，達到加速及備份的效果
3. 因為在Ring 0下操作檔案系統容易造成系統掛掉，常常要花很多時間在debug，因此有了這個fuse，我們便可以利用大量的user space debug tool來debug，縮短開發週期。
缺點就是在底層我們仍然需要做大量得Ring 0操作，需要大量的context switch，效能會比較差。