

# NASA Homework #2

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## Network Administration

### 1 CSMA/CD

Basically, switches don't need CSMA/CD because they make every port a separate collision domain and work in full-duplex mode. There won't be any chance that a collision occurs. However, There are still some devices that don't support full-duplex mode, and if a switch is connected to those devices, it still has to use CSMA/CD to work properly in half-duplex mode.

#### \* References

- <https://networkengineering.stackexchange.com/questions/45761/clarification-about-csma-cd-and-switch-ethernet>
- <https://geek-university.com/ccna/csma-cd-explained/>

### 2 Look Foward to being Fowarder

1. Start sshd in virtual machine: `$ sudo systemctl start sshd`
2. Use ssh remote forwarding to establish a ssh tunnel:  
`$ ssh -N -R 8889:localhost:22 b07902075@nasa-hw0.csie.ntu.edu.tw`
3. Now I can ssh into the virtual machine everywhere via nasa-hw0.csie.ntu.edu.tw

```
kaie@Asturia:~$ ssh zeus@nasa-hw0.csie.ntu.edu.tw -p 8889
The authenticity of host '[nasa-hw0.csie.ntu.edu.tw]:8889 ([140.112.30.160]:8889)' can't be established.
ECDSA key fingerprint is SHA256:g4UF9SF6zdhcR2P+8/3qN2H70zWNxRtmTEAppmGsJd8.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '[nasa-hw0.csie.ntu.edu.tw]:8889,[140.112.30.160]:8889' (ECDSA) to the list of known hosts.
zeus@nasa-hw0.csie.ntu.edu.tw's password:
Last login: Sat Mar 23 09:29:15 2019 from localhost
-bash-4.2$ history
1  shutdown now
2  lsblk -f
3  sudo vim /etc/crypttab
4  sudo vim /etc/fstab
5  exit
6  lsblk
```

#### \* References

- <https://www.ssh.com/ssh/tunneling/example>
- <https://unix.stackexchange.com/questions/145997/trying-to-ssh-to-local-vm-ubuntu-with-putty>

### 3 IPerf Everywhere

- Client: My laptop's WiFi  
Server: My smartphone's WiFi (with APP "Magic iPerf")

[ ID]	Interval		Transfer	Bandwidth	Retr	
[ 4]	0.00-10.00	sec	51.5 MBytes	43.2 Mbits/sec	0	sender
[ 4]	0.00-10.00	sec	50.3 MBytes	42.2 Mbits/sec		receiver

- Client: 204 PC  
Server: My laptop's WiFi

[ ID]	Interval		Transfer	Bandwidth	Retr	
[ 4]	0.00-10.00	sec	182 MBytes	152 Mbits/sec	0	sender
[ 4]	0.00-10.00	sec	181 MBytes	151 Mbits/sec		receiver

- Client: My laptop's WiFi  
Server: *CSIE linux1 workstation*

[ ID]	Interval		Transfer	Bandwidth	Retr	
[ 4]	0.00-10.00	sec	180 MBytes	151 Mbits/sec	28	sender
[ 4]	0.00-10.00	sec	176 MBytes	148 Mbits/sec		receiver

- Client: 204 PC  
Server: *CSIE linux1 workstation*

[ ID]	Interval		Transfer	Bandwidth		
[ 4]	0.00-10.00	sec	564 MBytes	473 Mbits/sec		sender
[ 4]	0.00-10.00	sec	564 MBytes	473 Mbits/sec		receiver

\* Conclusion:

I observe that the bandwidth between CSIE linux1 workstation and 204 PC(result 4) is the fastest one, while the bandwidth between My laptop's WiFi and linux1 workstation(result 3) and that between 204 PC and My laptop's WiFi(result 2) second, with approximately similar results. Finally, The bandwidth between My laptop's WiFi and My smartphone's WiFi(result 1) is the worst. I consider that this result is because WiFi is slower than cable. The routing path between 204 and linux1 is the fastest because they are totally connected with cable and their locations are also very close. The routing path of result 2 and 3 both pass through WiFi first, then cable, so their bandwidths are slowed down by the WiFi part. The result 1, with both ends connected with WiFi, then becomes slowest because of more slow part.

# System Administration

## 1 More space (15 pts)

1. Create a new partition: Since this machine use msdos partition table, and it has used three primary partitions, I have to make a extended partition on the rest space, then create logical partition on it.  

```
$ sudo parted /dev/sda
(parted) mkpart extended 11.7GB 100%
(parted) mkpart logical 11.7GB 14.7GB
$ sudo partprobe
```
2. Create physical volume & extend volume group:  

```
$ sudo pvcreate /dev/sda5
$ sudo vgextend Zeus /dev/sda5
```
3. Enlarge logical volume:  

```
$ sudo lvresize -L +1GB /dev/Zeus/video
```
4. Resize file system: Since the file system is locked, I need to unlock it first.  

```
$ sudo mount -o remount,rw /home/zeus/course
$ sudo resize2fs /dev/Zeus/video
```
5. Done.

```
-bash-4.2$ lsblk; df -h;
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
sda	8:0	0	20G	0	disk	
├─sda1	8:1	0	1G	0	part	/boot
├─sda2	8:2	0	9G	0	part	
│ └─Zeus-root	253:0	0	2G	0	lvm	/
│ └─Zeus-swap	253:1	0	2G	0	lvm	[SWAP]
│ └─Zeus-home	253:2	0	4G	0	lvm	/home
│ └─Zeus-video	253:3	0	2G	0	lvm	/home/zeus/course
├─sda3	8:3	0	909M	0	part	
├─sda4	8:4	0	512B	0	part	
└─sda5	8:5	0	2.8G	0	part	
└─┬─Zeus-video	253:3	0	2G	0	lvm	/home/zeus/course

  

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/mapper/Zeus-root	2.0G	1.1G	730M	61%	/
devtmpfs	484M	0	484M	0%	/dev
tmpfs	496M	0	496M	0%	/dev/shm
tmpfs	496M	6.7M	489M	2%	/run
tmpfs	496M	0	496M	0%	/sys/fs/cgroup
/dev/sda1	1000M	102M	856M	11%	/boot
/dev/mapper/Zeus-home	3.9G	17M	3.6G	1%	/home
/dev/mapper/Zeus-video	2.0G	919M	958M	49%	/home/zeus/course
tmpfs	100M	0	100M	0%	/run/user/1000

```
-bash-4.2$ _
```

## 2 New Video (5 pts)

1. First mount the device.  

```
$ sudo mount /dev/sda3 /mnt/media/
```
2. Since I have unlocked the file system in previous problem, I can just copy it.  

```
$ cp /mnt/media/new-video.mp4 /home/zeus/course
```

## 3 Encrypted Homework (15pts)

1. Install *cryptsetup*: 

```
$ sudo yum install -y cryptsetup
```

2. Make backup: `$ sudo tar -cv --exclude=/home/zeus/course* -f /root/home-backup /home`
3. Unmount devices: `$ sudo umount /home/zeus/course && sudo umount /home`
4. Encrypt `/dev/mapper/Zeus-home`: `$ sudo cryptsetup luksFormat /dev/Zeus/home`
5. Unlock device and recover files:
 

```
$ sudo cryptsetup luksOpen /dev/Zeus/home b07902075
$ sudo mkfs -t ext4 /dev/mapper/b07902075
$ sudo mount /dev/mapper/b07902075 /home
$ sudo tar -xvf /root/home-backup -C / && mkdir /home/zeus/course
```
6. Edit `/etc/crypttab` and `/etc/fstab`:
  - \* In `crypttab` add `b07902075 UUID=[UUID_of_/dev/mapper/Zeus-home] none`
  - \* In `fstab` change `/dev/mapper/Zeus-home` to `/dev/mapper/b07902075`
7. Reboot and check if everything works.

Please enter passphrase for disk Zeus-home (b07902075) on /home!:\*\*\*\*\*

```
-bash-4.2$ lsblk; df -h;
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                                  8:0      0   20G  0 disk
├─sda1                              8:1      0    1G  0 part  /boot
├─sda2                              8:2      0    9G  0 part
│   ├─Zeus-root                    253:0      0    2G  0 lvm    /
│   ├─Zeus-swap                    253:1      0    2G  0 lvm    [SWAP]
│   ├─Zeus-home                    253:2      0    4G  0 lvm
│   │   └─b07902075                253:4      0    4G  0 crypt /home
│   └─Zeus-video                   253:3      0    2G  0 lvm    /home/zeus/course
├─sda3                              8:3      0   909M  0 part
├─sda4                              8:4      0    1K  0 part
├─sda5                              8:5      0   2.8G  0 part
│   └─Zeus-video                   253:3      0    2G  0 lvm    /home/zeus/course
Filesystem                        Size  Used Avail Use% Mounted on
/dev/mapper/Zeus-root             2.0G  1.1G  729M  61% /
devtmpfs                          484M     0  484M   0% /dev
tmpfs                             496M     0  496M   0% /dev/shm
tmpfs                             496M  6.7M  489M   2% /run
tmpfs                             496M     0  496M   0% /sys/fs/cgroup
/dev/sda1                        1008M  102M  856M  11% /boot
/dev/mapper/b07902075             3.9G   16M   3.7G   1% /home
/dev/mapper/Zeus-video            2.0G   1.8G   97M  95% /home/zeus/course
tmpfs                            100M     0   100M   0% /run/user/1000
-bash-4.2$ _
```

## 4 Backup (10pts)

1. Take snapshot: `$ sudo lvcreate -L 1GB -s -n backup /dev/mapper/Zeus-video`
2. *tar* the snapshot:  
`$ sudo mkdir /mnt/home-snapshot && sudo mount /dev/Zeus/backup /mnt/home-snapshot/`  
`$ sudo tar -cvf /home/backup-video.tar /mnt/home-snapshot`
3. `$ lsblk`

```
-bash-4.2$ lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                                  8:0      0   20G  0 disk
├─sda1                              8:1      0    1G  0 part  /boot
├─sda2                              8:2      0    9G  0 part
│   ├─Zeus-root                     253:0      0    2G  0 lvm    /
│   ├─Zeus-swap                     253:1      0    2G  0 lvm    [SWAP]
│   ├─Zeus-home                     253:2      0    4G  0 lvm
│   │   └─b07902075                 253:4      0    4G  0 crypt  /home
│   └─Zeus-video-real               253:5      0    2G  0 lvm
│       ├─Zeus-video                 253:3      0    2G  0 lvm    /home/zeus/course
│       └─Zeus-backup                253:7      0    2G  0 lvm    /mnt/home-snapshot
├─sda3                              8:3      0  909M  0 part
├─sda4                              8:4      0     1K  0 part
└─sda5                              8:5      0   2.8G  0 part
    ├─Zeus-video-real               253:5      0    2G  0 lvm
    │   ├─Zeus-video                 253:3      0    2G  0 lvm    /home/zeus/course
    │   └─Zeus-backup                253:7      0    2G  0 lvm    /mnt/home-snapshot
    └─Zeus-backup-cow               253:6      0    1G  0 lvm
        └─Zeus-backup                253:7      0    2G  0 lvm    /mnt/home-snapshot
-bash-4.2$ _
```

4. `$ sudo lvremove /dev/Zeus/backup`

### \* References

- Discuss with *b07902064*

## 5 Experiment (5pts)

- Short answer:
  1. Differences between *ext4* and *btrfs* file system:

ext4	btrfs
no built-in snapshot feature	can take writable or read-only snapshots
don't support multi-devices natively	integrated multiple devices support(e.g. RAID 1)
none	can create subvolumes

2. RAID 0, RAID 1, RAID 5

- **RAID 0:** Needs at least 2 disks to form. It distributes data among all the disks, so the performance will be multiplied by the number of disks, which significantly increases the throughput of read/write. However, if one of the disks is broken, all data will be lost.
- **RAID 1:** Needs at least 2 disks to form. It "mirroring" the data for a set of disks, so every disk contains the same data. As long as there is at least one disk survives, all the data will be intact. Theoretically, RAID 1's read performance is the sum of all drive, while the write speed is certainly slower because it has to write to all of the disks in the set.

- **RAID 5:** Needs at least 3 disks to form. It stores a "parity information" for all blocks of data alternately among a set of disks (N-1 disks contain real data, 1 disk contains the parity). If one disk fails, it can recover its data from the other disks' data and the parity by XOR operation. The read speed is faster than only one disk, but the write speed is lower due to additional calculation. RAID 5 can boost the performance when considering the reliability.

- **Bonus**

1. Make partitions: `$ sudo parted /dev/sda`  
 (parted) `mkpart logical 14.7GB 16.7GB`  
 (parted) `mkpart logical 16.7GB 18.7GB`
2. Create file system: `$ sudo mkfs.btrfs -L meow -d raid1 /dev/sda6 /dev/sda7`
3. Mount device: `$ sudo mkdir /btrfsdisk && sudo mount LABEL=meow /btrfsdisk`
4. `$ lsblk; sudo btrfs filesystem show;`

```
-bash-4.2$ lsblk:sudo btrfs filesystem show;
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                                  8:0      0   20G  0 disk
├─sda1                              8:1      0    1G  0 part  /boot
├─sda2                              8:2      0    9G  0 part
│   ├─Zeus-root                    253:0      0    2G  0 lvm    /
│   ├─Zeus-swap                    253:1      0    2G  0 lvm    [SWAP]
│   ├─Zeus-home                    253:2      0    4G  0 lvm
│   └─b07902075                    253:4      0    4G  0 crypt /home
│       └─Zeus-video                253:3      0    2G  0 lvm    /home/zeus/course
├─sda3                              8:3      0  909M  0 part
├─sda4                              8:4      0   512B  0 part
├─sda5                              8:5      0    2.8G  0 part
│   └─Zeus-video                    253:3      0    2G  0 lvm    /home/zeus/course
├─sda6                              8:6      0    1.9G  0 part  /btrfsdisk
└─sda7                              8:7      0    1.9G  0 part

Label: 'meow'  uuid: d4d8ae55-ee9f-4e9e-9869-ee6c1d9e9fef
      Total devices 2 FS bytes used 256.00KiB
      devid 1 size 1.86GiB used 389.25MiB path /dev/sda6
      devid 2 size 1.86GiB used 389.25MiB path /dev/sda7

-bash-4.2$ _
```