# 10. Managing the System

서보경

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# 목차

# 1. Monitoring Resources
# Monitoring Memory Use

- $ free (메모리 사용량 확인)

```
bok_suh@Bok:~$ free
              total        used        free      shared  buff/cache   available
Mem:       24340732      869148    16158300        7980     7313284    23074320
Swap:        459260           0      459260
```

- -m : megabytes
- -g : gigabytes
- -b : blocks
- -t : totals 표시
- -s 5 : 5초마다 표시

# 1. Monitoring Resources
# Monitoring Memory Use

- $ top (화면으로 메모리 사용량을 보고 싶을 때)
- Default : 3초마다 갱신

- '1' 눌러 CPU 확인 가능

```
%Cpu0  :  0.3 us,  1.3 sy,  0.0 ni, 98.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu1  :  0.0 us,  1.0 sy,  0.0 ni, 99.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu2  :  0.3 us,  3.0 sy,  0.0 ni, 96.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
%Cpu3  :  0.3 us,  1.7 sy,  0.0 ni, 98.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
```

```
top - 18:14:58 up  4:06,  1 user,  load average: 0.00, 0.03, 0.01
Tasks: 209 total,   1 running, 207 sleeping,   0 stopped,   1 zombie
%Cpu(s):  0.2 us,  0.4 sy,  0.0 ni, 99.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :  23770.2 total,  15784.4 free,    841.8 used,   7144.1 buff/cache
MiB Swap:    448.5 total,    448.5 free,      0.0 used.  22538.2 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 428473 bok_suh   20   0 1126752  64484  43356 S   2.0   0.3   0:02.43 Xorg
 428692 bok_suh   20   0 4866496 347708 128004 S   1.6   1.4   0:07.98 gnome-shell
 436808 bok_suh   20   0  814896  51076  39848 S   1.3   0.2   0:01.04 gnome-terminal-
      1 root      20   0  169164  13348   8464 S   0.0   0.1   2:57.68 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.01 kthreadd
      3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp
      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-k+
      9 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
     10 root      20   0       0      0      0 S   0.0   0.0   0:00.09 ksoftirqd/0
     11 root      20   0       0      0      0 I   0.0   0.0   0:01.17 rcu_sched
     12 root      rt   0       0      0      0 S   0.0   0.0   0:00.06 migration/0
     13 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
     14 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
     15 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
     16 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
     17 root      rt   0       0      0      0 S   0.0   0.0   0:06.94 migration/1
     18 root      20   0       0      0      0 S   0.0   0.0   0:00.09 ksoftirqd/1
     20 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-k+
     21 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
     22 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/2
     23 root      rt   0       0      0      0 S   0.0   0.0   0:06.92 migration/2
     24 root      20   0       0      0      0 S   0.0   0.0   0:00.09 ksoftirqd/2
     26 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/2:0H-k+
     27 root      20   0       0      0      0 S   0.0   0.0   0:00.00 cpuhp/3
     28 root     -51   0       0      0      0 S   0.0   0.0   0:00.00 idle_inject/3
     29 root      rt   0       0      0      0 S   0.0   0.0   0:06.92 migration/3
```

# 1. Monitoring Resources
# Monitoring Memory Use

- $ vmstat (일정 시간 동안의 메모리 사용량 확인)

- -S M : 1024k MB
- -n 2 10 : 2초 간격, 10번 반복

```
bok_suh@Bok:~$ vmstat 3
procs -----------memory---------- ---swap-- -----io---- -system-- ------cpu-----
 r  b   swpd   free   buff  cache   si   so    bi    bo   in   cs us sy id wa st
 0  0      0 16143508 151032 7164876    0    0    28    83   48   88  0  0 99  0  0
 0  0      0 16143500 151032 7164876    0    0     0     0  166  261  0  0 100  0  0
 0  0      0 16143500 151032 7164876    0    0     0     0  175  285  0  0 100  0  0
 1  0      0 16143500 151032 7164876    0    0     0     0  161  238  0  0 100  0  0
 0  0      0 16144320 151032 7164876    0    0     0     0  417 1067  0  1 99  0  0
 2  0      0 16144540 151032 7164872    0    0     0     0  285  309  0  4 96  0  0
 0  0      0 16144780 151032 7164772    0    0     0   144  258  327  0  0 99  0  0
 1  0      0 15775212 151144 7346088    0    0 53268   819 5214 9623 17  9 71  3  0
 0  0      0 15704748 151180 7354300    0    0   765   111 2161 3098  8  3 89  0  0
 2  0      0 15668364 151184 7359788    0    0  1103     0 3310 6286  7  3 90  0  0
 0  0      0 15958208 151408 7330912    0    0  2287   739 6791 11376 24 14 62  0  0
 0  0      0 15959036 151408 7330692    0    0     0     0  894 1931  0  2 98  0  0
 0  0      0 15959036 151416 7330692    0    0     0    31  169  266  0  0 100  0  0
```

# 1. Monitoring Resources
# Monitoring Memory Use

- # vmstat –m | less (kernel slab memory cache statistics)

```
Cache                        Num  Total   Size  Pages
isofs_inode_cache             72     72    656     24
ext4_groupinfo_4k            252    252    144     28
fsverity_info                  0      0    256     16
MPTCPv6                        0      0   1856     17
ip6-frags                      0      0    184     22
PINGv6                         0      0   1216     26
RAWv6                        156    156   1216     26
UDPv6                        216    216   1344     24
tw_sock_TCPv6                  0      0    248     16
request_sock_TCPv6             0      0    304     26
TCPv6                        117    117   2368     13
kcopyd_job                     0      0   3312      9
dm_uevent                      0      0   2888     11
scsi_sense_cache             160    160    128     32
mqueue_inode_cache            17     17    960     17
fuse_inode                    76     76    832     19
ecryptfs_key_record_cache      0      0    576     28
ecryptfs_inode_cache           0      0   1024     16
ecryptfs_file_cache            0      0     16    256
ecryptfs_auth_tok_list_item      0      0    832     19
fat_inode_cache               22     22    744     22
Cache                        Num  Total   Size  Pages
fat_cache                      0      0     40    102
squashfs_inode_cache       14201  14260    704     23
jbd2_journal_head            578    714    120     34
jbd2_revoke_table_s          256    256     16    256
ext4_inode_cache           80882  85144   1096     29
ext4_allocation_context      128    128    128     32
ext4_io_end                 1216   1216     64     64
ext4_pending_reservation     512    512     32    128
ext4_extent_status         48239  48552     40    102
mbcache                     1679   1679     56     73
:
```

# 1. Monitoring Resources
# Monitoring Memory Use

- # slabtop
- 3초마다 갱신

```
Active / Total Objects (% used)    : 1956779 / 1993630 (98.2%)
Active / Total Slabs (% used)      : 55749 / 55749 (100.0%)
Active / Total Caches (% used)     : 101 / 144 (70.1%)
Active / Total Size (% used)       : 366238.98K / 380003.04K (96.4%)
Minimum / Average / Maximum Object : 0.01K / 0.19K / 8.00K

  OBJS ACTIVE  USE OBJ SIZE  SLABS OBJ/SLAB CACHE SIZE NAME
1127022 1122649  99%    0.10K  28898       39    115592K buffer_head
152103 142925  93%    0.19K   7243       21     28972K dentry
 87104  85922  98%    0.12K   2722       32     10888K kernfs_node_cache
 85144  80882  94%    1.07K   2936       29     93952K ext4_inode_cache
 61440  61440 100%    0.01K    120      512       480K kmalloc-8
 48552  48238  99%    0.04K    476      102      1904K ext4_extent_status
 49392  45999  93%    0.57K   1764       28     28224K radix_tree_node
 45056  44038  97%    0.03K    352      128      1408K kmalloc-32
 43168  42581  98%    0.20K   2272       19      9088K vm_area_struct
 42816  41012  95%    0.06K    669       64      2676K anon_vma_chain
 23184  22804  98%    0.09K    504       46      2016K anon_vma
 23322  22451  96%    0.59K    897       26     14352K inode_cache
 18208  16356  89%    0.25K   1138       16      4552K filp
 15744  14585  92%    0.06K    246       64       984K kmalloc-64
 14260  14201  99%    0.69K    620       23      9920K squashfs_inode_cache
 12544  12544 100%    0.02K     49      256       196K kmalloc-16
 11390  11390 100%    0.02K     67      170       268K lsm_file_cache
 11136  10637  95%    0.06K    174       64       696K vmap_area
  9912   8582  86%    0.66K    413       24      6608K proc_inode_cache
 10176   8048  79%    0.06K    159       64       636K kmalloc-rcl-64
  6848   6848 100%    0.12K    214       32       856K pid
  6783   6783 100%    0.08K    133       51       532K task_delay_info
  5334   5334 100%    0.19K    254       21      1016K cred_jar
  4656   4471  96%    0.50K    291       16      2328K kmalloc-512
  4335   4335 100%    0.05K     51       85       204K ftrace_event_field
  4182   4182 100%    0.04K     41      102       164K pde_opener
```

# 1. Monitoring Resources
# Monitoring CPU Usage

- $ iostat –c 3 (3초마다 CPU stats)

```
bok_suh@Bok:~$ iostat -c 3
Linux 5.8.0-43-generic (Bok)    2021년 02월 15일        _x86_64_        (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.18    0.03    0.32    0.02    0.00   99.45


avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.17    0.00    0.17    0.00    0.00   99.67


avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.17    0.00    0.08    0.00    0.00   99.75
```

- -c -t : 시간과 함께 표시
- -c -t 2 10 : 2초마다 출력, 10번 반복

# 1. Monitoring Resources
# Monitoring CPU Usage

- $ dstat -c 3 (CPU 사용 정보 확인)
- -t -c 3 : 3초 마다 시간과 함께 출력

```
bok_suh@Bok:~$ dstat -t -c 3
----system---- --total-cpu-usage--
     time     |usr sys idl wai stl
15-02 18:55:56|  0   0  99   0   0
15-02 18:55:59|  0   0 100   0   0
15-02 18:56:02|  0   0 100   0   0
15-02 18:56:05| 13   5  82   0   0
15-02 18:56:08|  9   4  88   0   0
15-02 18:56:11| 27   9  62   2   0
15-02 18:56:14| 32  10  58   0   0
15-02 18:56:16|  4   2  94   0   0^C
```

- $ top 에서 ‘Shift+p’로 CPU usage로 정렬가능

- $ cat /proc/cpuinfo (CPU 정보 확인)

```
bok_suh@Bok:~$ cat /proc/cpuinfo
processor       : 0
vendor_id       : GenuineIntel
cpu family      : 6
model           : 165
model name      : Intel(R) Core(TM) i5-10400 CPU @ 2.90GHz
stepping        : 5
cpu MHz         : 2903.998
cache size      : 12288 KB
physical id     : 0
siblings        : 4
core id         : 0
cpu cores       : 4
apicid          : 0
initial apicid  : 0
fpu             : yes
fpu_exception   : yes
cpuid level     : 22
wp              : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clfl
ush mmx fxsr sse sse2 ht syscall nx rdtscp lm constant_tsc rep_good nopl xtopology nonstop_tsc
 cpuid tsc_known_freq pni pclmulqdq ssse3 cx16 pcid sse4_1 sse4_2 x2apic movbe popcnt aes xsav
e avx rdrand hypervisor lahf_lm abm 3dnowprefetch invpcid_single fsgsbase avx2 invpcid rdseed
clflushopt md_clear flush_l1d arch_capabilities
t               : spectre_v1 spectre_v2 spec_store_bypass swapgs itlb_multihit
t               : 5807.99
clflush size    : 64
cache_alignment : 64
address sizes   : 39 bits physical, 48 bits virtual
power management:
```

VBox_GAs_6.1.16

# 1. Monitoring Resources
# Monitoring Storage Devices

- $ iostat 3

```
bok_suh@Bok:~$ iostat 3
Linux 5.8.0-43-generic (Bok)    2021년 02월 15일        _x86_64_        (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.19    0.03    0.32    0.02    0.00   99.43

Device             tps    kB_read/s    kB_wrtn/s    kB_dscd/s    kB_read    kB_wrtn    kB_dscd
loop0             0.02         0.05         0.00         0.00        840          0          0
loop1             0.03         0.32         0.00         0.00       5729          0          0
loop10            0.01         0.12         0.00         0.00       2122          0          0
loop2             0.07         0.46         0.00         0.00       8175          0          0
loop3             0.03         0.12         0.00         0.00       2106          0          0
loop4             0.05         0.11         0.00         0.00       1980          0          0
loop5             0.21         0.57         0.00         0.00      10029          0          0
loop6             0.00         0.02         0.00         0.00        362          0          0
loop7             0.00         0.02         0.00         0.00        430          0          0
loop8             0.11         0.84         0.00         0.00      14813          0          0
loop9             0.02         0.05         0.00         0.00        859          0          0
sda               4.38       117.19       306.15         0.00    2076161    5423805          0
scd0              0.00         0.01         0.00         0.00         91          0          0
```

- $ vmstat -d

```
bok_suh@Bok:~$ vmstat -d
disk- ------------reads------------ ------------writes----------- -----IO------
       total merged sectors      ms  total merged sectors      ms    cur    sec
loop0    267      0    1680      27      0      0       0       0      0      0
loop1    618      0   11458      92      0      0       0       0      0      0
loop2   1294      0   16350     138      0      0       0       0      0      0
loop3    565      0    4212      54      0      0       0       0      0      0
loop4    907      0    3960      51      0      0       0       0      0      0
loop5   3768      0   20058      94      0      0       0       0      0      1
loop6     49      0     724       9      0      0       0       0      0      0
loop7     56      0     860      38      0      0       0       0      0      0
sr0       42      0     182       9      0      0       0       0      0      0
sda    54523  17387 4152322   18933  23241  35942 10848874   48651      0     37
loop8   1890      0   29626     677      0      0       0       0      0      2
loop9    313      0    1718      19      0      0       0       0      0      0
loop10   124      0    4244      50      0      0       0       0      0      0
```

- $ vmstat -p sda1 (파티션에 대해 확인)

```
bok_suh@Bok:~$ vmstat -p sda1
sda1            reads      read sectors      writes  requested writes
                  141             11470           3                10
```

# 1. Monitoring Resources
# Monitoring Storage Devices

- $ lsof | less (현재 실행되고 있는 파일 및 디렉토리)

```
COMMAND      PID    TID TASKCMD             USER   FD      TYPE            DEVICE SIZE/OFF
     NODE NAME
systemd        1                            root  cwd   unknown
          /proc/1/cwd (readlink: Permission denied)
systemd        1                            root  rtd   unknown
          /proc/1/root (readlink: Permission denied)
systemd        1                            root  txt   unknown
          /proc/1/exe (readlink: Permission denied)
systemd        1                            root NOFD
          /proc/1/fd (opendir: Permission denied)
kthreadd       2                            root  cwd   unknown
          /proc/2/cwd (readlink: Permission denied)
kthreadd       2                            root  rtd   unknown
          /proc/2/root (readlink: Permission denied)
kthreadd       2                            root  txt   unknown
          /proc/2/exe (readlink: Permission denied)
kthreadd       2                            root NOFD
          /proc/2/fd (opendir: Permission denied)
rcu_gp         3                            root  cwd   unknown
          /proc/3/cwd (readlink: Permission denied)
```

- -c bash (files opened by bash shells)
- -d cwd (current directory로 열려 있는 directories)

# 2. Mastering Time
# Changing Time/Date with Graphical Tools

- System clock (리눅스가 사용)
- Hardware clock (리눅스 부팅될 때 system clock 설정)

- /etc/localtime file로 리눅스 시간대 설정

- $ sudo cp /usr/share/zoneinfo/Asia/Seoul /etc/localtime
- $ sudo ln -s /usr/share/zoneinfo/Asia/Seoul /etc/localtime

# 2. Mastering Time
# Disaplaying and Setting Your System Clock

- $ date (날짜/시간/시간대 출력)

```
bok_suh@Bok:~$ date
2021. 02. 15. (월) 20:52:23 KST
bok_suh@Bok:~$ date '+%A %B %d %G'
월요일 2월 15 2021
bok_suh@Bok:~$ date '+The date today is %F.'
The date today is 2021-02-15.
bok_suh@Bok:~$ date --date='4 weeks'
2021. 03. 15. (월) 20:52:37 KST
bok_suh@Bok:~$ date --date='8 months 3 days'
2021. 10. 18. (월) 20:52:44 KST
bok_suh@Bok:~$ date --date='4 Jul' +%A
일요일
```

- $ cal (달력 표시)

```
bok_suh@Bok:~$ cal
      2월 2021
일 월 화 수 목 금 토
    1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28
```

# 2. Mastering Time
# Displaying and Setting Your System Clock

- $ sudo date 081215212013 (8월 12일 15시 21분 2013년 설정)
- $ sudo date --set='+7 minutes' (7분 뒤로 시간 설정)
- $ sudo date --set='-1 month' (1달 앞으로 시간 설정)

# 2. Mastering Time
# Displaying and Setting Your Hardware Clock

- $ sudo hwclock -r (show hardware clock settings)
- $ sudo hwclock --hctosys (hardware clock → system clock)
- $ sudo hwclock --systohc (system clock → hardware clock)
- $ sudo hwclock --adjust (오차 없애기)
- $ sudo hwclock --set --date="8/12/13 18:22:00" (새로 설정)

# 3. Managing the Boot Process
# Understanding the GRUB Boot Loader

- /boot/grub/grub.cfg

```
menuentry 'Ubuntu' --class ubuntu --class gnu-linux --class gnu --class os $menuentry_id_optio
n 'gnulinux-simple-d6c09973-4544-40bf-b2e0-cccad4a74734' {
        recordfail
        load_video
        gfxmode $linux_gfx_mode
        insmod gzio
        if [ x$grub_platform = xxen ]; then insmod xzio; insmod lzopio; fi
        insmod part_msdos
        insmod ext2
        set root='hd0,msdos5'
        if [ x$feature_platform_search_hint = xy ]; then
          search --no-floppy --fs-uuid --set=root --hint-bios=hd0,msdos5 --hint-efi=hd0,msdos5
 --hint-baremetal=ahci0,msdos5  d6c09973-4544-40bf-b2e0-cccad4a74734
        else
          search --no-floppy --fs-uuid --set=root d6c09973-4544-40bf-b2e0-cccad4a74734
        fi
        linux   /boot/vmlinuz-5.8.0-43-generic root=UUID=d6c09973-4544-40bf-b2e0-cccad4a74734
ro  quiet splash $vt_handoff
        initrd  /boot/initrd.img-5.8.0-43-generic
}
```

# 3. Managing the Boot Process
# Modifying the GRUB Boot Loader

- GRUB(Grand Unified Boot Loader) configuration 수정 방법

- 1. Custom File
  - /etc/grub.d/40_custom 에 추가

- 2. Default File
  - /etc/default/grub 에서 수정 후 *update-grub* cmd 실행

# 4. Controlling Startup and Run Levels

- $ runlevel

```
bok_suh@Bok:~$ runlevel
3 5
```

- 0 : halt (시스템 종료)
- 1 : Single user mode (시스템 복원 모드)
- 2 : Multiuser mode (다중 사용자 모드)
- 3 : Full multiuser mode (텍스트 유저 모드)
- 4 : (사용 안함)
- 5 : X11 (그래픽 유저 모드)
- 6 : reboot (재부팅)

# 4. Controlling Startup and Run Levels

- $ /etc/init.d/ntp (usage statement 표시)

```
bok_suh@Bok:~$ /etc/init.d/ntp
Usage: /etc/init.d/ntp {start|stop|restart|try-restart|force-reload|status}
```

- $ sudo /etc/init.d/ntp status (NTP 체크)

```
bok_suh@Bok:~$ sudo /etc/init.d/ntp status
● ntp.service - Network Time Service
     Loaded: loaded (/lib/systemd/system/ntp.service; enabled; vendor preset: enabled)
     Active: active (running) since Mon 2021-02-15 21:34:27 KST; 6s ago
       Docs: man:ntpd(8)
    Process: 845912 ExecStart=/usr/lib/ntp/ntp-systemd-wrapper (code=exited, status=0/SUCCESS)
   Main PID: 845920 (ntpd)
      Tasks: 2 (limit: 28455)
     Memory: 1.5M
     CGroup: /system.slice/ntp.service
             └─845920 /usr/sbin/ntpd -p /var/run/ntpd.pid -g -u 127:135

 2월  15 21:34:27 Bok ntpd[845920]: Listen and drop on 1 v4wildcard 0.0.0.0:123
 2월  15 21:34:27 Bok ntpd[845920]: Listen normally on 2 lo 127.0.0.1:123
 2월  15 21:34:27 Bok ntpd[845920]: Listen normally on 3 enp0s3 10.0.2.15:123
 2월  15 21:34:27 Bok ntpd[845920]: Listen normally on 4 lo [::1]:123
 2월  15 21:34:27 Bok ntpd[845920]: Listen normally on 5 enp0s3 [fe80::474b…:123
 2월  15 21:34:27 Bok ntpd[845920]: Listening on routing socket on fd #22 f…ates
 2월  15 21:34:27 Bok ntpd[845920]: kernel reports TIME_ERROR: 0x2041: Cloc…ized
 2월  15 21:34:27 Bok ntpd[845920]: kernel reports TIME_ERROR: 0x2041: Cloc…ized
 2월  15 21:34:27 Bok systemd[1]: Started Network Time Service.
 2월  15 21:34:33 Bok ntpd[845920]: Soliciting pool server 211.233.40.78
Hint: Some lines were ellipsized, use -l to show in full.
```

# 5. Straight to the Kernel

- $ uname -r (kernel release 표시)
- $ uname -a (kernel info 표시)

```
bok_suh@Bok:~$ uname -r
5.8.0-43-generic
bok_suh@Bok:~$ uname -a
Linux Bok 5.8.0-43-generic #49~20.04.1-Ubuntu SMP Fri Feb 5 09:57:56 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
```

- $ dmesg | less (kernel ring buffer 컨텐츠 표시)

```
[    0.000000] Linux version 5.8.0-43-generic (buildd@lcy01-amd64-018) (gcc (Ubuntu 9.3.0-17ubuntu1~20.04) 9.3
.0, GNU ld (GNU Binutils for Ubuntu) 2.34) #49~20.04.1-Ubuntu SMP Fri Feb 5 09:57:56 UTC 2021 (Ubuntu 5.8.0-43
.49~20.04.1-generic 5.8.18)
[    0.000000] Command line: BOOT_IMAGE=/boot/vmlinuz-5.8.0-43-generic root=UUID=d6c09973-4544-40bf-b2e0-cccad
4a74734 ro quiet splash
[    0.000000] KERNEL supported cpus:
[    0.000000]   Intel GenuineIntel
[    0.000000]   AMD AuthenticAMD
[    0.000000]   Hygon HygonGenuine
[    0.000000]   Centaur CentaurHauls
[    0.000000]   zhaoxin   Shanghai
```

# 5. Straight to the Kernel

- $ lsmod (로드된 module의 이름 표시)
- $ modinfo *module name* (모듈에 대한 더 많은 정보)

- $ sudo modprobe *module name* (모듈 로드)
- $ sudo modprobe -r *module name* (모듈 제거)

- $ sudo sysctl -a | less (kernel parameters 리스트)
- $ sudo sysctl *kernel parameter* (특정 파라미터 값 표시)

```
bok_suh@Bok:~$ sudo sysctl kernel.hostname
kernel.hostname = Bok
```

# 6. Poking at the Hardware

- $ lspci (PCI hardware items)

```
bok_suh@Bok:~$ lspci
00:00.0 Host bridge: Intel Corporation 440FX - 82441FX PMC [Natoma] (rev 02)
00:01.0 ISA bridge: Intel Corporation 82371SB PIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:02.0 VGA compatible controller: VMware SVGA II Adapter
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)
00:04.0 System peripheral: InnoTek Systemberatung GmbH VirtualBox Guest Service
00:05.0 Multimedia audio controller: Intel Corporation 82801AA AC'97 Audio Controller (rev 01)
00:06.0 USB controller: Apple Inc. KeyLargo/Intrepid USB
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA Controller [AHCI mode] (rev 02)
```

- $ sudo dmidecode | less (hardware components)
- $ sudo hdparm /dev/sda (hard disk settings)

```
bok_suh@Bok:~$ sudo hdparm /dev/sda

/dev/sda:
 multcount     = 128 (on)
 IO_support    =  1 (32-bit)
 readonly      =  0 (off)
 readahead     = 256 (on)
 geometry      = 4177/255/63, sectors = 67108864, start = 0
```

# 감사합니다.