Ch4 Introduction of Linux System
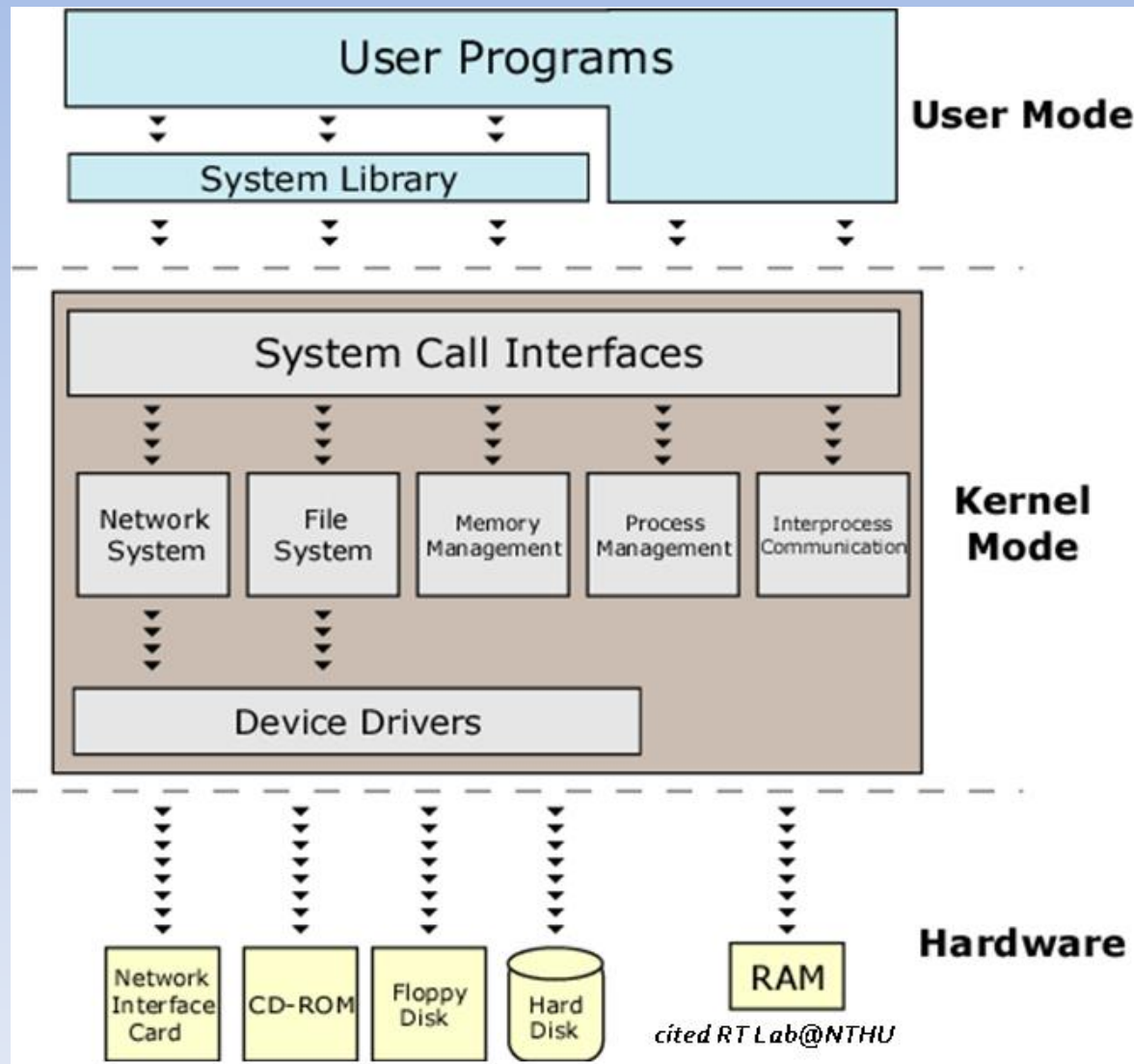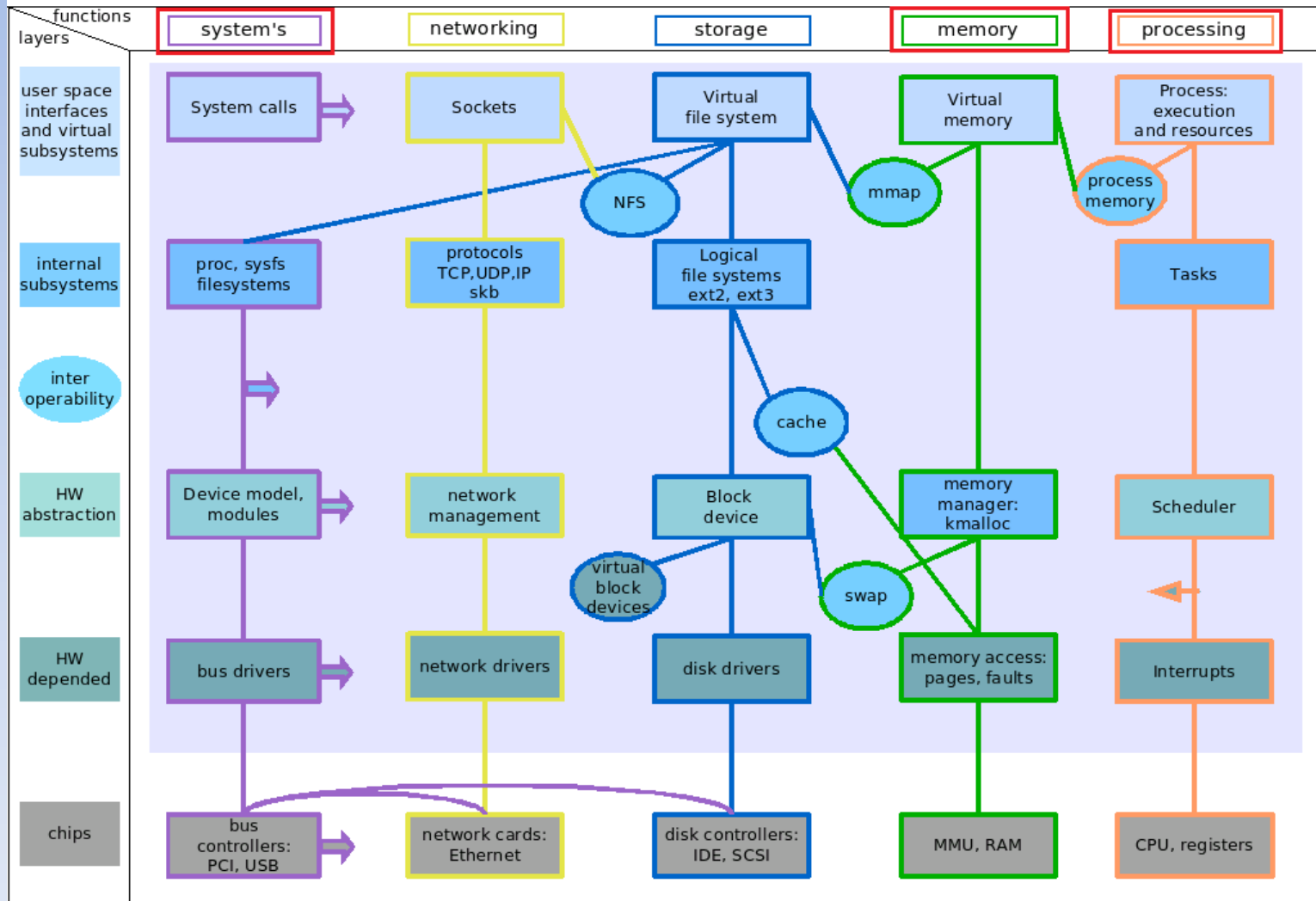
謝明志(Jimin Hsieh)

Agenda

- 4-1 Linux System Architecture
- 4-2 Linux Kernel Diagram
- 4-3 Linux Kernel Map
- 4-4 top
- 4-5 ps
- 4-6 pstree
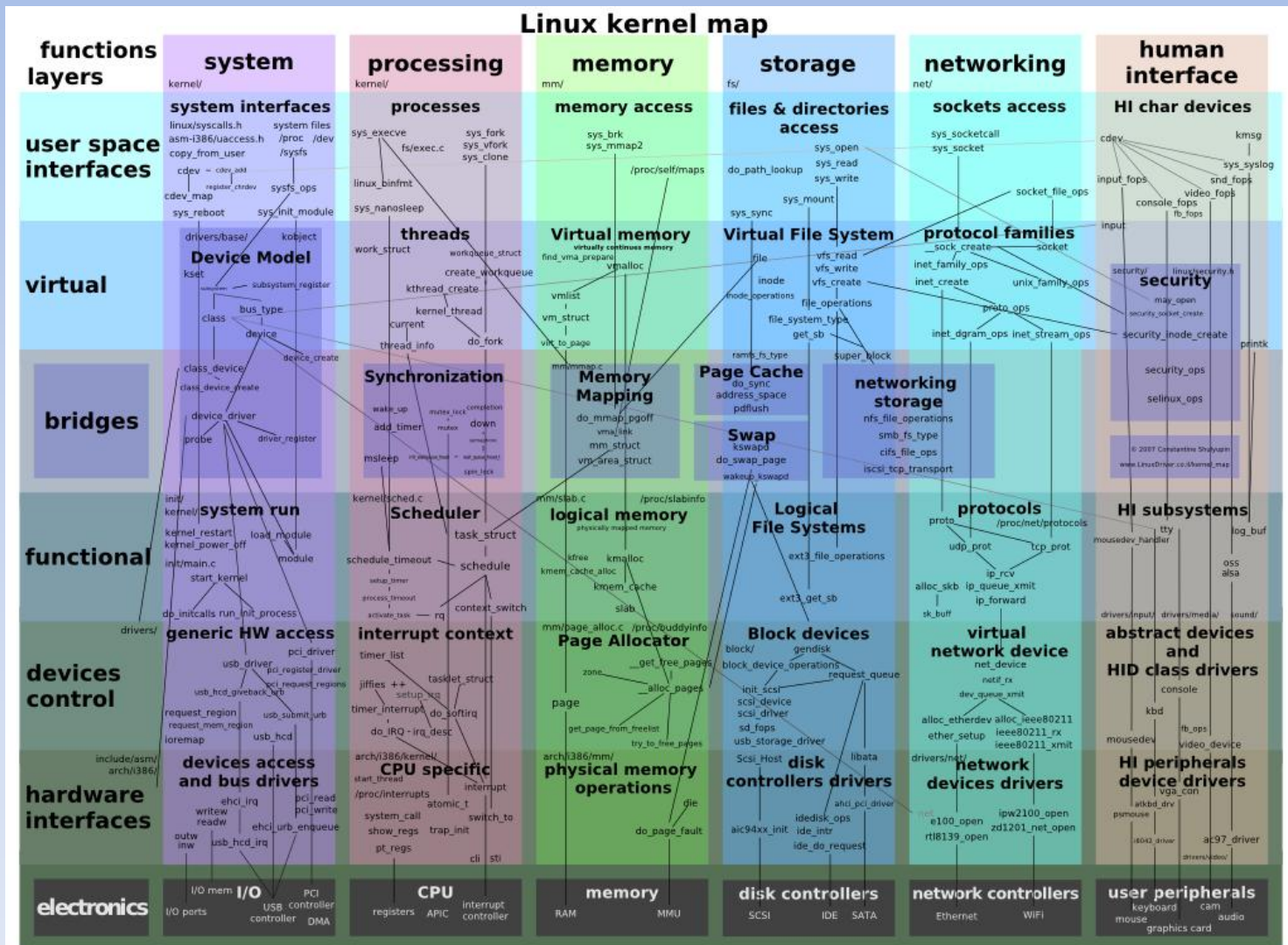- 4-7 proc
- 4-8 System Messages

Linux System Architecture

User Programs — User Mode

System Library

System Call Interfaces

Network System | File System | Memory Management | Process Management | Interprocess Communication — Kernel Mode

Device Drivers

Network Interface Card | CD-ROM | Floppy Disk | Hard Disk | RAM — Hardware

cited RT Lab@NTHU

3

Linux Kernel Diagram

Simplified Linux kernel diagram in form of a matrix map

Designed with OpenOffice.org by (cc) (by-nc-sa) Constantine Shulyupin, www.linuxdriver.co.il

4

Linux Kernel Map

Linux kernel map

top

top : display Linux processes

top

- us: user space process

- sy: kernel space process

- Id: idle time

- hi: hardware interrupt

- si: software interrupt

top

top -H –p [PID]

Option "-H" thread mode

Option "-p [PID]" specific Process

ps

ps

Option"aux"

pstree

/proc

/proc: Virtual File System

- /proc/cpuinfo

- /proc/meminfo

- /proc/version

cpuinfo

- /proc/cpuinfo
- flags infor: linux/arch/x86/include/asm/cpufeature.h


```
processor       : 0
vendor id       : GenuineIntel
cpu family      : 6
model           : 23
model name      : Intel(R) Core(TM)2 Quad CPU     Q8400  @ 2.66GHz
stepping        : 10
microcode       : 0xa07
cpu MHz         : 2003.000
cache size      : 2048 KB
physical id     : 0
siblings        : 4
core id         : 0
cpu cores       : 4
apicid          : 0
initial apicid  : 0
fpu             : yes
fpu_exception   : yes
cpuid level     : 13
wp              : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pa
t pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx lm constant_tsc
 arch_perfmon pebs bts rep_good nopl aperfmperf pni dtes64 monitor ds_cpl vmx est
tm2 ssse3 cx16 xtpr pdcm sse4_1 xsave lahf_lm dtherm tpr_shadow vnmi flexpriority
bogomips        : 5320.05
clflush size    : 64
cache_alignment : 64
address sizes   : 36 bits physical, 48 bits virtual
power management:
```

meminfo

- /proc/meminfo

```
MemTotal:        12204744 kB
MemFree:          4988984 kB
Buffers:           220208 kB
Cached:           1352572 kB
SwapCached:             0 kB
Active:           1810772 kB
Inactive:         1279632 kB
Active(anon):     1087820 kB
Inactive(anon):    457204 kB
Active(file):      722952 kB
Inactive(file):    822428 kB
Unevictable:           16 kB
Mlocked:               16 kB
SwapTotal:        1316860 kB
SwapFree:         1316292 kB
Dirty:                132 kB
Writeback:              4 kB
AnonPages:        1517688 kB
Mapped:           4037068 kB
Shmem:              27388 kB
Slab:              142880 kB
SReclaimable:       67712 kB
SUnreclaim:         75168 kB
KernelStack:         4696 kB
```

free

- # free

```
                total          used          free        shared       buffers        cached
Mem:         12204744       7488672       4716072             0        225012       1370332
-/+ buffers/cache:          5893328       6311416
Swap:         1316860           568       1316292
```

version

- /proc/version

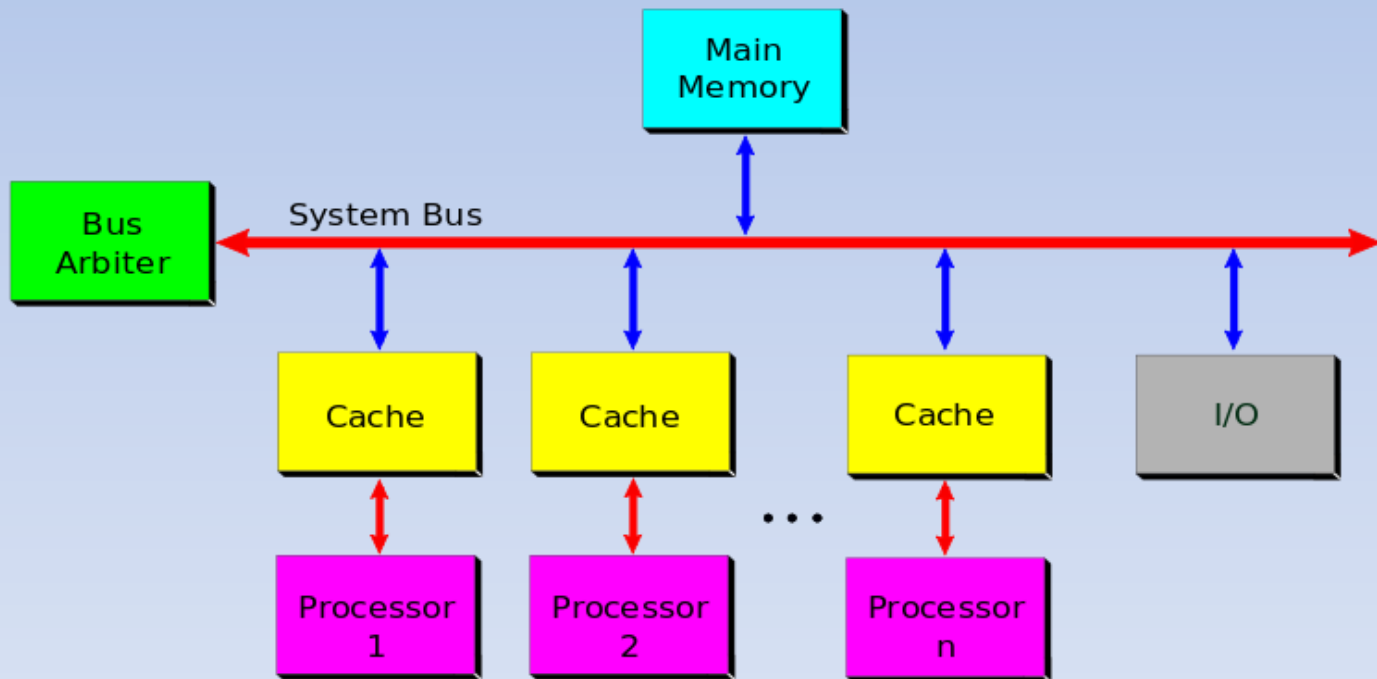- # uname -a

```
Linux version 3.2.0-4.amd64 (debian-kernel@lists.debian.org) (gcc version 4.6.3 (D
ebian_4.6.3-14) ) #1 SMP Debian 3.2.51-1
```

- 3.2.51-1

- 3: Kernel version

- 2: Major revision,

  even number: stable

  odd number: develop

- 51: Minor revision

- 1: corrections- patches and bug fixes

What is SMP?

SMP - Symmetric Multiprocessor System

By Ferruccio Zulian - Milan.Italy

System Messages

- # dmesg : debug message in kernel space
- /var/log/messages

```
[ 1344.031116] usb 1-1.2: USB disconnect, device number 3
[ 1395.126474] CPUM: APIC 01 at 00000000fee00000 (mapped at ffffc9000186e000) - ver 0x0
[ 1395.126490] CPUM: APIC 00 at 00000000fee00000 (mapped at ffffc90017960000) - ver 0x0
[ 1395.126504] CPUM: APIC 03 at 00000000fee00000 (mapped at ffffc90006616000) - ver 0x0
[ 1395.126541] CPUM: APIC 02 at 00000000fee00000 (mapped at ffffc9000187e000) - ver 0x0
[ 1395.340767] device eth0 entered promiscuous mode
[ 1461.697425] ADDRCONF(NETDEV_UP): wlan0: link is not ready
[ 1463.622647] wlan0: authenticate with 78:54:2e:5c:47:8e (try 1)
[ 1463.626473] wlan0: authenticated
[ 1463.660837] wlan0: associate with 78:54:2e:5c:47:8e (try 1)
[ 1463.666914] wlan0: RX AssocResp from 78:54:2e:5c:47:8e (capab=0x431 status=0 aid=5)
[ 1463.666919] wlan0: associated
[ 1463.677556] ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
[ 1473.972581] wlan0: no IPv6 routers present
[ 1649.792077] CPU3: Package power limit notification (total events = 771)
[ 1649.792081] CPU2: Package power limit notification (total events = 771)
[ 1649.792100] CPU0: Package power limit notification (total events = 771)
[ 1649.792104] CPU1: Package power limit notification (total events = 770)
[ 1649.794065] CPU2: Package power limit normal
[ 1649.794073] CPU3: Package power limit normal
[ 1649.794083] CPU0: Package power limit normal
[ 1649.794092] CPU1: Package power limit normal
```

lsmod

- # lsmod: show kernel module

```
iptable_nat            12928  1
nf_nat                 18242  2 iptable_nat,ipt_MASQUERADE
nf_conntrack_ipv4      14078  4 nf_nat,iptable_nat
nf_defrag_ipv4         12483  1 nf_conntrack_ipv4
xt_state               12503  1
nf_conntrack           52720  5 xt_state,nf_conntrack_ipv4,nf_nat,iptable_nat,ipt_MASQUERADE
```

Q&A

Thanks for you attentions!