

# Processi, Memoria e File System

Quando si parla di Linux, ci si riferisce a GNU/Linux

**GCC** (GNU compiler collection)

**GDB** (GNU debugger)

**GIMP** (GNU image manipulation program)

**GNOME** (desktop environment)



GNU (GNU is not Unix)



**FHS** (Filesystem Hierarchy Standard), **Pseudo Filesystem**

Uno **Pseudo Filesystem** è volatile (come la RAM)

**/proc** (processi)

**/sys** (info sui dispositivi)

**/dev** (accesso ai dispositivi)



# SSH (**secure shell**)

Esecuzione remota di comandi:

Router CISCO

Data Center

Troubleshooting



PowerShell di Windows 10

```
ssh utente@ip:22
```

Ho il controllo (da CLI) del computer

```
cicio@DESKTOP-DAMT32J D: [13:49]
> ssh daniel@192.168.1.124
daniel@192.168.1.124's password:
Last login: Sun Mar 28 13:49:00 2021
from 192.168.1.170
daniel@daniel-TravelMate-5744Z:~$
```

# /proc

A /proc non conviene accedere direttamente (si usano comandi)

```
daniel@daniel-TravelMate-5744Z:~$ ls /proc
```

1	14	15	1742	1852	28	4111	770	88
10	14002	1548	1743	186	29	4130	78	892
100	14097	1566	1744	1861	3	4770	787	894
102	14101	1571	1745	187	30	518	79	895
104	14146	1575	1759	188	311	5406	8	9
105	14192	1577	1760	189	312	6	80	90
11	14229	1596	1769	2	367	622	8042	91
115	14249	1598	1784	20	391	734	81	93
118	14344	16	1787	21	394	738	82	94
12	14430	1600	1795	22	396	739	83	95
12243	1445	1607	18	23	398	740	84	96
12268	1446	1612	1812	24	4	742	85	969
12269	14463	17	1816	2482	400	743	860	97
131	14559	1701	1833	2483	402	747	861	974
1313	14564	1702	1836	25	404	751	863	98
13235	1462	1731	1840	2552	406	754	865	99
1344	14638	1738	1844	26	408	761	87	991
13984	1493	1739	1848	27	410	77	873	9957

```
daniel@daniel-TravelMate-5744Z:~$
```

PID dei vare processi in esecuzione

996	fs	modules	thread-self
9988	interrupts	mounts	timer_list
acpi	iomem	mtrr	tty
asound	ioports	net	uptime
buddyinfo	irq	pagetypeinfo	version
bus	kallsyms	partitions	version_signature
cgroups	kcore	pressure	vmallocinfo
cmdline	keys	sched_debug	vmstat
consoles	key-users	schedstat	zoneinfo
cpuinfo	kmsg	scsi	
crypto	kpagecgroup	self	
devices	kpagecount	slabinfo	
diskstats	kpageflags	softirqs	
dma	loadavg	stat	
driver	locks	swaps	
execdomains	mdstat	sys	
fb	meminfo	sysrq-trigger	
filesystems	misc	sysvipc	

Parametri di avvio del kernel

Utilizzo della memoria

Moduli caricati nel kernel

Molti dei file non sono modificabili (neanche da root)



# Gerarchia dei processi

Quando il kernel finisce il boot avvia il primo processo (PID 1)

/lib/systemd/systemd (è più moderno)

/sbin/init (più vecchio e lento)

SystemV e Systemd sono un insieme di software per il kernel

```
sysadmin@localhost:~$ pstree
init--+-check-new-relea
      |-cron
      |-login---bash---pstree
      |-named---3*[{named}]
      |-rsyslogd---2*[{rsyslogd}]
      ^-sshd
sysadmin@localhost:~$
```

C'è un valore **massimo** per i PID

La PPID è il PID del **genitore**

```
daniel@daniel-TravelMate-5744Z:~$ pstree
systemd--ModemManager--2*[{ModemManager}]
        --NetworkManager--dhclient
                        2*[{NetworkManager}]
        --accounts-daemon--2*[{accounts-daemon}]
        --acpid
        --agetty
        --avahi-daemon--avahi-daemon
        --colord--2*[{colord}]
        --cron
        --cups-browsed--2*[{cups-browsed}]
        --cupsd
        --dbus-daemon
        --irqbalance--{irqbalance}
        --2*[{kerneloops}]
        --lightdm--Xorg--9*[{Xorg}]
```

# ps (snapshot processi della shell)

```
daniel@daniel-TravelMate-5744Z:~$ ps
  PID TTY          TIME CMD
 7678 pts/0        00:00:00 bash
10902 pts/0        00:00:00 ps
daniel@daniel-TravelMate-5744Z:~$ ps --forest
  PID TTY          TIME CMD
 7678 pts/0        00:00:00 bash
10903 pts/0        00:00:00 \_ ps
daniel@daniel-TravelMate-5744Z:~$
```

```
daniel@daniel-TravelMate-5744Z:~$ ps
  PID TTY          TIME CMD
12269 pts/0        00:00:00 bash
15153 pts/0        00:00:00 ps
daniel@daniel-TravelMate-5744Z:~$ ps -f
  UID      PID  PPID  C  STIME TTY          TIME CMD
daniel  12269 12268  0  16:58 pts/0        00:00:00 -bash
daniel  15154 12269  0  20:44 pts/0        00:00:00 ps -f
daniel@daniel-TravelMate-5744Z:~$ ps -F
  UID      PID  PPID  C    SZ    RSS  PSR  STIME TTY          TIME CMD
daniel  12269 12268  0   5690  5292   0  16:58 pts/0        00:00:00 -bash
daniel  15155 12269  0   9345  3520   0  20:44 pts/0        00:00:00 ps -F
daniel@daniel-TravelMate-5744Z:~$
```

```
daniel@daniel-TravelMate-5744Z:~$ ps aux
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1   0.0  0.2 160256  9508 ?        Ss   11:33   0:03 /sbin/init splash
root         2   0.0  0.0      0      0 ?        S    11:33   0:00 [kthreadd]
root         3   0.0  0.0      0      0 ?        I<   11:33   0:00 [rcu_gp]
root         4   0.0  0.0      0      0 ?        I<   11:33   0:00 [rcu_par_gp]
root         6   0.0  0.0      0      0 ?        I<   11:33   0:00 [kworker/0:0H-kb]
root         8   0.0  0.0      0      0 ?        I<   11:33   0:00 [mm_percpu_wq]
root         9   0.0  0.0      0      0 ?        S    11:33   0:01 [ksoftirqd/0]
root        10   0.0  0.0      0      0 ?        I    11:33   0:16 [rcu_sched]
root        11   0.0  0.0      0      0 ?        S    11:33   0:00 [migration/0]
root        12   0.0  0.0      0      0 ?        S    11:33   0:00 [idle_inject/0]
root        14   0.0  0.0      0      0 ?        S    11:33   0:00 [cpuhp/0]
```

-e (tutti i processi)

-f (full format)

-F (extra full format)

-u (user)

--forest



# ps (pt 2)

```
daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'firefox'
8730 ?      00:00:13 firefox
daniel@daniel-TravelMate-5744Z:~$ kill 8730
daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'firefox'
daniel@daniel-TravelMate-5744Z:~$
```

uptime

```
daniel@daniel-TravelMate-5744Z:~$ uptime
21:24:06 up 9:50, 2 users, load average: 2,27 1,90 2,00
daniel@daniel-TravelMate-5744Z:~$
```

- uptime
- media ultimi 5 minuti
- media ultimi 10 minuti
- media ultimi 15 minuti

```
daniel@daniel-TravelMate-5744Z:~$ ps -u daniel
PID TTY      TIME CMD
1445 ?        00:00:00 systemd
1446 ?        00:00:00 (sd-pam)
1462 ?        00:00:00 xfce4-session
1493 ?        00:00:03 dbus-daemon
1548 ?        00:00:00 ssh-agent
1566 ?        00:00:00 at-spi-bus-laun
1571 ?        00:00:00 dbus-daemon
1575 ?        00:00:00 xfconfd
1577 ?        00:00:00 at-spi2-registr
1598 ?        00:00:00 gpg-agent
1600 ?        00:00:42 xfwm4
1607 ?        00:00:00 gvfsd
1612 ?        00:00:00 gvfsd-fuse
1701 ?        00:00:00 xfsettingsd
1702 ?        00:00:11 xfce4-panel
1731 ?        00:00:04 Thunar
1738 ?        00:00:01 panel-27-whiske
1739 ?        00:00:04 xfdesktop
1742 ?        00:00:00 panel-9-notific
1743 ?        00:00:00 panel-10-xapp-s
1744 ?        00:00:00 panel-11-power-
```

```
1833 ?        00:00:00 xfce4-volumed
1836 ?        00:00:00 gvfs-udisks2-vo
1840 ?        00:00:00 gvfs-goa-volume
1844 ?        00:00:00 gvfs-mtp-volume
1848 ?        00:00:00 gvfs-gphoto2-vo
1852 ?        00:00:00 gvfs-afc-volume
1861 ?        00:00:00 gvfsd-trash
2552 ?        00:00:00 gvfsd-metadata
4111 ?        00:00:03 xfce4-appfinder
7677 ?        00:00:00 sshd
7678 pts/0      00:00:00 bash
9957 ?        00:00:00 gvfsd-network
9988 ?        00:00:00 gvfsd-dnssd
10402 ?       00:00:00 xfce4-terminal
10406 pts/1      00:00:00 bash
10680 pts/0      00:00:00 ps
```

```
daniel@daniel-TravelMate-5744Z:~$ ps -u root
PID TTY      TIME CMD
1 ?      00:00:03 systemd
2 ?      00:00:00 kthreadd
3 ?      00:00:00 rcu_gp
4 ?      00:00:00 rcu_par_gp
6 ?      00:00:00 kworker/0:0H-kb
8 ?      00:00:00 mm_percpu_wq
9 ?      00:00:00 ksoftirqd/0
10 ?     00:00:03 rcu_sched
11 ?     00:00:00 migration/0
12 ?     00:00:00 idle_inject/0
14 ?     00:00:00 cpuhp/0
15 ?     00:00:00 cpuhp/1
16 ?     00:00:00 idle_inject/1
17 ?     00:00:00 migration/1
18 ?     00:00:00 ksoftirqd/1
20 ?     00:00:00 kworker/1:0H-kb
21 ?     00:00:00 kdevtmpfs
22 ?     00:00:00 netns
23 ?     00:00:00 rcu_tasks_kthre
24 ?     00:00:00 kauditd
25 ?     00:00:00 khungtaskd
26 ?     00:00:00 oom_reaper
27 ?     00:00:00 writeback
28 ?     00:00:00 kcompactd0
29 ?     00:00:00 ksm
30 ?     00:00:00 khugepaged
77 ?     00:00:00 kintegrityd
78 ?     00:00:00 kblockd
79 ?     00:00:00 blkcg_punt_bio
80 ?     00:00:00 tpm_dev_wq
81 ?     00:00:00 ata_sff
82 ?     00:00:00 md
83 ?     00:00:00 edac-poller
84 ?     00:00:00 devfreq_wq
85 ?     00:00:00 watchdogd
87 ?     00:00:00 kswapd0
88 ?     00:00:00 ecryptfs-kthrea
90 ?     00:00:00 kthrotld
91 ?     00:00:00 acpi_thermal_pm
93 ?     00:00:00 scsi_eh_0
94 ?     00:00:00 scsi_tmf_0
95 ?     00:00:00 scsi_eh_1
96 ?     00:00:00 scsi_tmf_1
97 ?     00:00:00 scsi_eh_2
98 ?     00:00:00 scsi_tmf_2
```



# top (real time)

K (kill process)

R (renice)

H (help)

q (per uscire)

Help for Interactive Commands - procs-ng 3.3.12

Window **1:Def**: Cumulative mode Off. **System**: Delay 3,0 secs; Secure mode Off.

Z,B,E,e Global: 'Z' colors; 'B' bold; 'E'/'e' summary/task memory scale  
l,t,m Toggle Summary: 'l' load avg; 't' task/cpu stats; 'm' memory info  
0,1,2,3,I Toggle: '0' zeros; '1/2/3' cpus or numa node views; 'I' Irix mode  
f,F,X Fields: 'f'/'F' add/remove/order/sort; 'X' increase fixed-width

L,&,<,> . Locate: 'L'/'&' find/again; Move sort column: '<'/'>' left/right  
R,H,V,J . Toggle: 'R' Sort; 'H' Threads; 'V' Forest view; 'J' Num justify  
c,i,S,j . Toggle: 'c' Cmd name/line; 'i' Idle; 'S' Time; 'j' Str justify  
x,y . Toggle highlights: 'x' sort field; 'y' running tasks  
z,b . Toggle: 'z' color/mono; 'b' bold/reverse (only if 'x' or 'y')  
u,U,o,O . Filter by: 'u'/'U' effective/any user; 'o'/'O' other criteria  
n,#,^0 . Set: 'n'/'#' max tasks displayed; Show: Ctrl+'0' other filter(s)  
C, ... . Toggle scroll coordinates msg for: up,down,left,right,home,end

k,r Manipulate tasks: 'k' kill; 'r' renice

d or s Set update interval

W,Y Write configuration file 'W'; Inspect other output 'Y'

q Quit

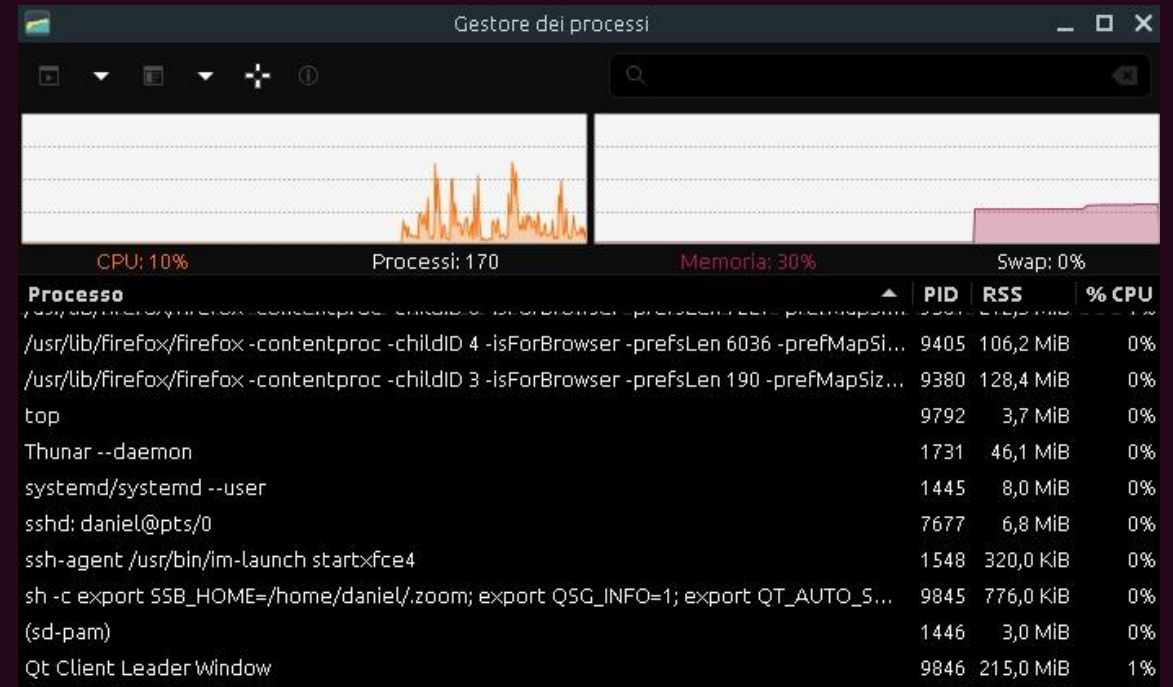
( commands shown with '.' require a visible task display window )

Press 'h' or '?' for help with Windows,

Type 'q' or <Esc> to continue

```
top - 14:09:34 up 2:35, 2 users, load average: 0,10, 0,34, 0,51
Tasks: 170 total, 1 running, 124 sleeping, 0 stopped, 0 zombie
%Cpu(s): 1,4 us, 1,7 sy, 0,0 ni, 96,3 id, 0,5 wa, 0,0 hi, 0,2 si, 0,0 st
KiB Mem : 3694300 total, 899708 free, 879436 used, 1915156 buff/cache
KiB Swap: 2097148 total, 2097148 free, 0 used. 2407208 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
9587	daniel	20	0	4155748	212524	96324	S	3,3	5,8	0:06.93	zoom
9267	daniel	20	0	3094536	297532	146008	S	2,3	8,1	0:16.13	firefox
991	root	20	0	940912	72448	44940	S	1,3	2,0	2:10.89	Xorg
9501	daniel	20	0	2955484	214260	131688	S	0,7	5,8	0:07.92	Web Content
9792	daniel	20	0	41800	3760	3132	R	0,7	0,1	0:00.84	top
1600	daniel	20	0	792832	59944	36608	S	0,3	1,6	0:32.77	xfwm4
9015	root	20	0	0	0	0	I	0,3	0,0	0:00.24	kworker/1:9+
1	root	20	0	160256	9508	6744	S	0,0	0,3	0:03.02	systemd
2	root	20	0	0	0	0	S	0,0	0,0	0:00.00	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/0:0+
8	root	0	-20	0	0	0	I	0,0	0,0	0:00.00	mm_percpu_wq
9	root	20	0	0	0	0	S	0,0	0,0	0:00.67	ksoftirqd/0
10	root	20	0	0	0	0	I	0,0	0,0	0:02.83	rcu_sched





# Memoria

Linux usa il **virtual addressing** per gestire i processi

Accesso alla memoria **senza conflitti**

La memoria è divisa in **blocchi**

Viene usata la memoria di **swap**

```
daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'firefox'
daniel@daniel-TravelMate-5744Z:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:           3,5G         426M         1,5G          62M         1,6G         2,8G
Swap:          2,0G           0B          2,0G
daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'firefox'
 8235 ?           00:00:19 firefox
daniel@daniel-TravelMate-5744Z:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:           3,5G         1,1G         1,0G         147M         1,7G         2,1G
Swap:          2,0G           0B          2,0G
daniel@daniel-TravelMate-5744Z:~$ █

daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'firefox'
 9033 ?           00:00:08 firefox
daniel@daniel-TravelMate-5744Z:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:           3,5G         782M         1,0G         111M         1,7G         2,4G
Swap:          2,0G           0B          2,0G
daniel@daniel-TravelMate-5744Z:~$ kill 9033
daniel@daniel-TravelMate-5744Z:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:           3,5G         426M         1,4G           72M         1,7G         2,8G
Swap:          2,0G           0B          2,0G
daniel@daniel-TravelMate-5744Z:~$ █
```

```
daniel@daniel-TravelMate-5744Z:~$ free -hs 10
              total        used        free      shared  buff/cache   available
Mem:           3,5G         426M         1,5G          62M         1,7G         2,8G
Swap:          2,0G           0B          2,0G

              total        used        free      shared  buff/cache   available
Mem:           3,5G         731M         1,1G          90M         1,7G         2,4G
Swap:          2,0G           0B          2,0G

              total        used        free      shared  buff/cache   available
Mem:           3,5G         847M         1,0G         100M         1,7G         2,3G
Swap:          2,0G           0B          2,0G

              total        used        free      shared  buff/cache   available
Mem:           3,5G         815M         1,0G         104M         1,7G         2,4G
Swap:          2,0G           0B          2,0G

              total        used        free      shared  buff/cache   available
Mem:           3,5G         1,0G         837M         120M         1,7G         2,1G
Swap:          2,0G           0B          2,0G

^C
daniel@daniel-TravelMate-5744Z:~$ █
```

**free** (info sulla RAM e sulla swap)

**-h** (umano)

**-s** (stampa ogni tot secondi)

**-m** (MB)

**-g** (GB)



# File di Log (Syslog)

L'output viene mandato in STDOUT, STDERR e nei file di log

Aiutano al **troubleshooting**

Alcuni processi usano i **daemon** per i log

I **daemon** sono servizi eseguiti in **background**

Esistono diversi **daemon** di per il **logging**

Syslogd & klogd

rsyslogd

journald (nei Systemd)

```
daniel@daniel-TravelMate-5744Z:~$ ps -e | grep 'daemon'
740 ?      00:00:00 avahi-daemon
751 ?      00:00:00 accounts-daemon
770 ?      00:00:02 dbus-daemon
787 ?      00:00:00 avahi-daemon
1493 ?     00:00:04 dbus-daemon
1571 ?     00:00:00 dbus-daemon
1769 ?     00:00:00 rtkit-daemon
daniel@daniel-TravelMate-5744Z:~$
```

```
daniel@daniel-TravelMate-5744Z:~$ ps -e | egrep 'mess
ages|cron|dmesg|maillog|secure|journal|Xorg.0.log'
367 ?      00:00:00 systemd-journal
738 ?      00:00:00 cron
daniel@daniel-TravelMate-5744Z:~$
```

File di log e comandi:

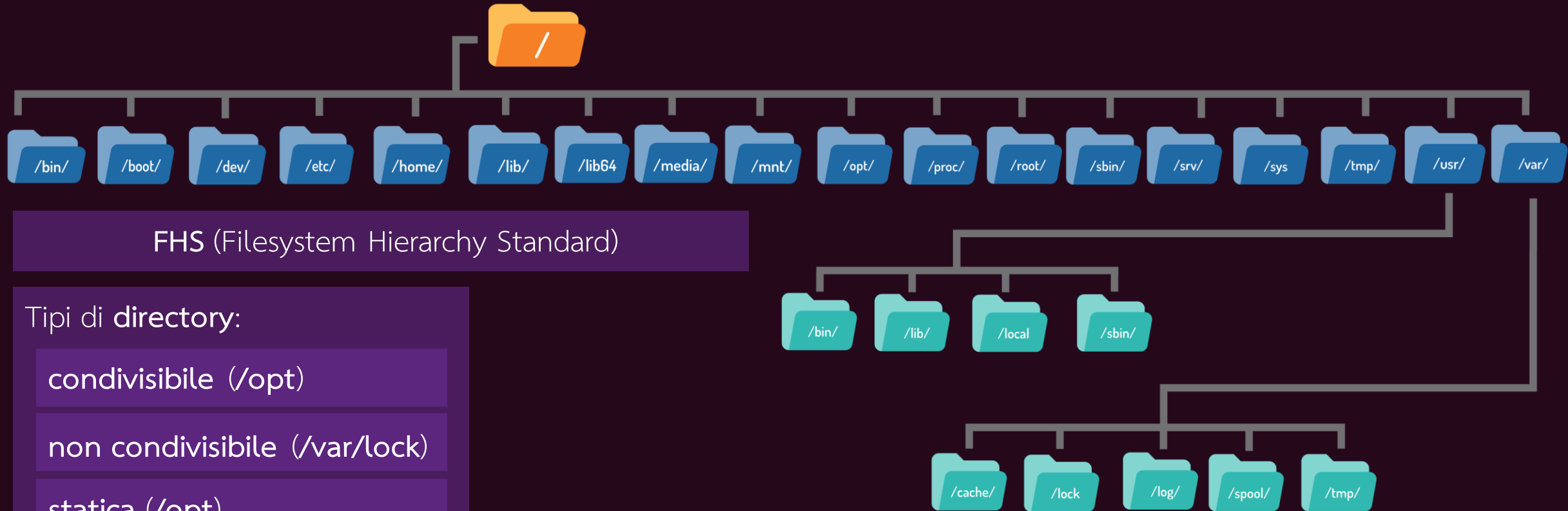
boot.log, cron, dmesg, maillog, messages, secure, journal, Xorg.0.log (cat, less, journalctl, file, lastb, last)

# dmesg

```
daniel@daniel-TravelMate-5744Z:~$ dmesg | grep -i usb
[ 0.302121] ACPI: bus type USB registered
[ 0.302121] usbcore: registered new interface driver usbfs
[ 0.302121] usbcore: registered new interface driver hub
[ 0.302121] usbcore: registered new device driver usb
[ 0.357294] pci 0000:00:1a.0: quirk_usb_early_handoff+0x0/0x6b0 took 18557 usecs
[ 0.377285] pci 0000:00:1d.0: quirk_usb_early_handoff+0x0/0x6b0 took 19498 usecs
[ 2.071298] ehci_hcd: USB 2.0 'Enhanced' Host Controller (EHCI) Driver
[ 2.071473] ehci-pci 0000:00:1a.0: new USB bus registered, assigned bus number 1
[ 2.089871] ehci-pci 0000:00:1a.0: USB 2.0 started, EHCI 1.00
[ 2.090283] usb usb1: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 5.04
[ 2.090288] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 2.090292] usb usb1: Product: EHCI Host Controller
[ 2.090295] usb usb1: Manufacturer: Linux 5.4.0-64-generic ehci_hcd
[ 2.090298] usb usb1: SerialNumber: 0000:00:1a.0
[ 2.090732] hub 1-0:1.0: USB hub found
[ 2.091559] ehci-pci 0000:00:1d.0: new USB bus registered, assigned bus number 2
[ 2.109817] ehci-pci 0000:00:1d.0: USB 2.0 started, EHCI 1.00
[ 2.109887] usb usb2: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 5.04
[ 2.109889] usb usb2: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 2.109890] usb usb2: Product: EHCI Host Controller
[ 2.109892] usb usb2: Manufacturer: Linux 5.4.0-64-generic ehci_hcd
[ 2.109893] usb usb2: SerialNumber: 0000:00:1d.0
[ 2.110052] hub 2-0:1.0: USB hub found
[ 2.110259] ohci_hcd: USB 1.1 'Open' Host Controller (OHCI) Driver
[ 2.110283] uhci_hcd: USB Universal Host Controller Interface driver
[ 2.425863] usb 1-1: new high-speed USB device number 2 using ehci-pci
[ 2.445866] usb 2-1: new high-speed USB device number 2 using ehci-pci
[ 2.582210] usb 1-1: New USB device found, idVendor=8087, idProduct=0020, bcdDevice= 0.00
[ 2.582215] usb 1-1: New USB device strings: Mfr=0, Product=0, SerialNumber=0
```



# Gerarchia del File System



Tipi di directory:

condivisibile (/opt)

non condivisibile (/var/lock)

statica (/opt)

variabile (/var/lock)