

# Linux and Unix Philosophy

# Linux

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Created by Linus Torvalds while still in college.  
It was the missing piece (kernel) to the puzzle  
of Free and Open Source Operating System along  
with the GNU coreutils created by Richard Stallman.



Linus Torvalds – creator of Linux Kernel



Richard Stallman (RMS) - creator of GNU, and GPL

# Unix Philosophy

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- Originated by Ken Thompson
- Set of cultural norms and philosophical approaches to
- minimal, modular, and SIMPLE software

# Unix Philosophy

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- Do one thing and do it well
- Write programs to work together
- Work on text streams, it is a universal interface

# Do one thing, Do it well

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Almost all of GNU and Unix coreutils are very simple and modular. They do one thing and do it well.

# Do one thing, Do it well

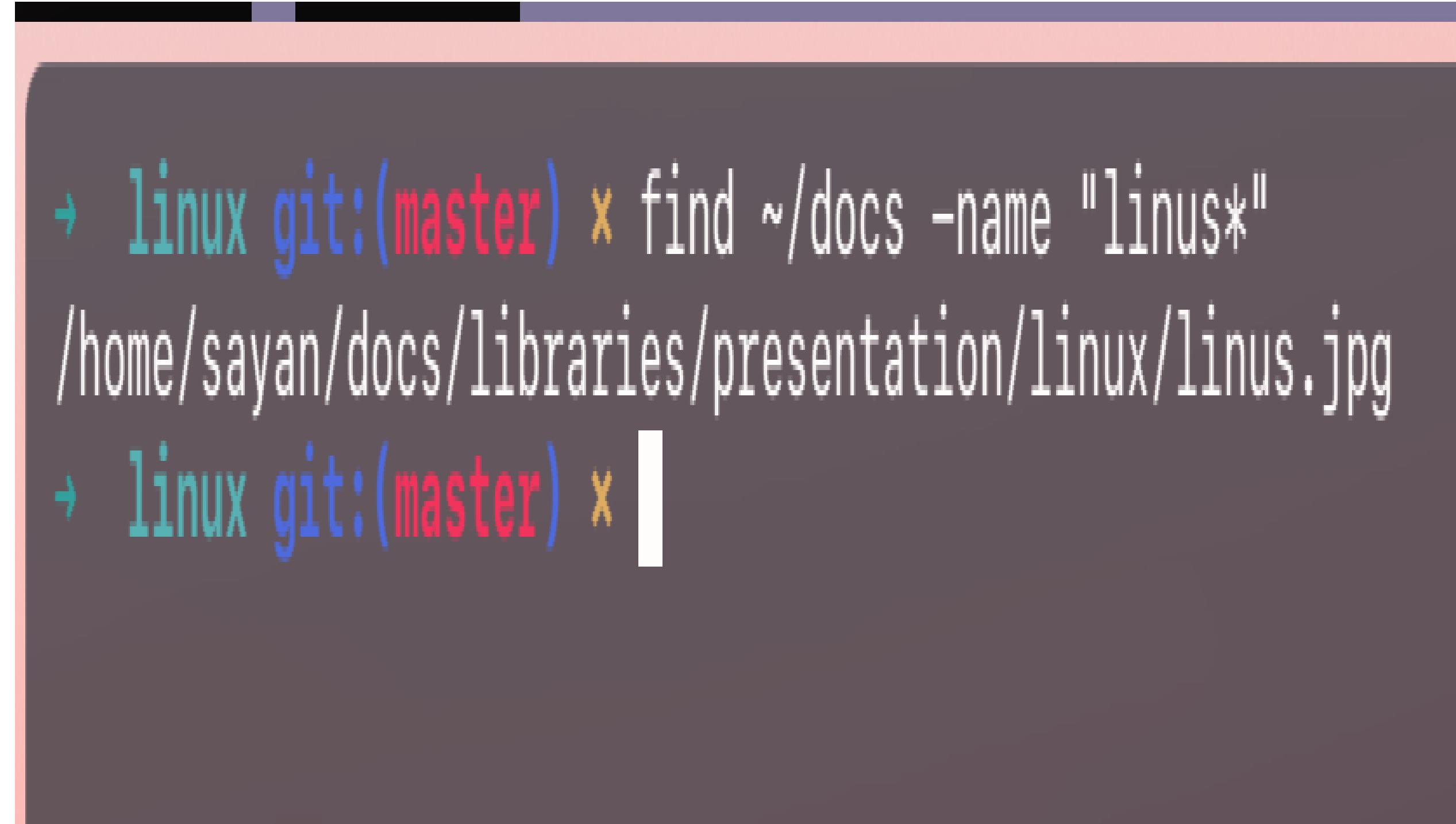
---

```
→ linux git:(master) ✘ df -hT
Filesystem      Type      Size  Used Avail Use% Mounted on
devtmpfs        devtmpfs  4.0M    0  4.0M  0% /dev
tmpfs           tmpfs     3.8G  176M  3.7G  5% /dev/shm
tmpfs           tmpfs     1.6G  1.6M  1.6G  1% /run
/dev/sdb1        ext4     96G   52G  39G  58% /
tmpfs           tmpfs     3.8G  41M  3.8G  2% /tmp
/dev/sdb2        ext4    323G  244G  64G  80% /home
/dev/sdb4        vfat    998M  150M  849M  15% /efi
tmpfs           tmpfs    776M  80K  776M  1% /run/user/1000
/dev/sda3        ext4    492G  392G  75G  84% /data
```

df – reports disk filesystem space usage

# Do one thing, Do it well

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A screenshot of a terminal window with a dark background and light-colored text. The window title bar is visible at the top. The terminal prompt is '→ linux git:(master) x'. The user has run the command 'find ~/docs -name "linus\*"'. The output shows a single file path: '/home/sayan/docs/libraries/presentation/linux/linus.jpg'. The terminal ends with another prompt '→ linux git:(master) x' followed by a cursor.

```
→ linux git:(master) x find ~/docs -name "linus*"  
/home/sayan/docs/libraries/presentation/linux/linus.jpg  
→ linux git:(master) x
```

find – lets you FIND files in your FS

# Write programs to work together

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Unix and GNU tools are simple and work on stdin and stdout. As such, they can easily be chained together by feeding output of one program into the input of another.

This is called PIPE (|)

# Write programs to work together

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```
→ linux git:(master) ✘ ps auxc --sort=-rss
USER        PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
sayan      34980  2.5  7.1 1923272 571792 ?      Ssl 18:24  0:35 ksnip
sayan      8936  35.5  6.1 1185952656 486752 ?      S1   18:07 14:14 chrome
sayan      3428  4.7  4.1 57215052 333156 ?      S1   18:03  2:06 WhatsApp
sayan      1477  3.4  3.3 34462308 267200 ?      Ssl 18:02  1:32 chrome
sayan      1684  0.5  2.9 1187897948 236852 ?      SNl 18:02  0:13 chrome
sayan      1521  9.0  2.6 34315832 209856 ?      S1   18:02  4:05 chrome
sayan      62897  0.3  2.5 1415116 199100 ?      S1   18:45  0:00 kioslave5
sayan      26725  0.2  2.4 270254664 198428 pts/1 S1+ 18:19  0:04 dolphin
sayan      31560  0.5  2.3 1220068 186312 ?      Ssl 18:22  0:08 konsole
sayan      3362  6.9  2.2 38445604 182680 ?      S1   18:03  3:06 WhatsApp
sayan      2517  0.4  2.2 1185844324 175868 ?      SNl 18:02  0:11 chrome
sayan      23146  0.0  2.1 1211184 167968 ?      Ssl 18:17  0:00 konsole
sayan      2143  0.3  2.0 1187945176 166600 ?      SNl 18:02  0:09 chrome
sayan      30174  0.0  2.0 1101740 160900 ?      S1   18:21  0:00 kded5
sayan      3395  0.8  1.9 34154480 157384 ?      S1   18:03  0:21 WhatsApp
sayan      2480  0.4  1.9 1187951992 151460 ?      S1   18:02  0:11 chrome
root       679  2.6  1.8 955476 146552 tty2      Ssl+ 18:02  1:11 Xorg
sayan      2493  0.4  1.7 1185856504 140656 ?      SNl 18:02  0:11 chrome
sayan      2780  0.3  1.7 1185856284 137848 ?      SNl 18:02  0:09 chrome
sayan      2458  0.1  1.6 1185813920 127496 ?      SNl 18:02  0:03 chrome
sayan      2208  0.1  1.5 1185823552 123568 ?      SNl 18:02  0:04 chrome
sayan      12737  0.0  1.5 2027888 123360 ?      S1   18:09  0:01 spotify
sayan      871  0.0  1.4 1433368 114092 ?      Ssl 18:02  0:01 kmix
sayan      2343  0.1  1.4 1185810996 113156 ?      SNl 18:02  0:03 chrome
sayan      887  0.0  1.4 1323120 112804 ?      Ssl 18:02  0:00 barrier
sayan      1655  0.2  1.3 1185800796 110628 ?      S1   18:02  0:07 chrome
sayan      6547  0.2  1.3 1215124 109952 ?      Ssl 18:05  0:07 konsole
sayan      12717  0.4  1.3 2961036 108144 ?      S1   18:09  0:09 spotify
sayan      785  0.0  1.2 1219072 103220 ?      Ssl 18:02  0:02 xfce4-clipman
```

ps – lists processes running on the system

# Write programs to work together

---

```
→ linux git:(master) ✘ ps auxc --sort=-rss | head
USER        PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
sayan      34980  3.4  7.3 1956056 585436 ?      Ssl 18:24   0:49 ksnip
sayan      8936  36.0  6.2 1185952656 494924 ?      Sl   18:07  14:39 chrome
sayan      3428  4.7  4.1 57206856 333156 ?      Sl   18:03   2:07 WhatsApp
sayan      1477  3.3  3.3 34462308 266992 ?      Ssl 18:02   1:33 chrome
sayan      1684  0.5  3.0 1187897948 241668 ?      SNl 18:02   0:13 chrome
sayan      1521  9.1  2.6 34315832 210424 ?      Sl   18:02   4:11 chrome
sayan      26725  0.3  2.4 270252744 197224 pts/1 Sl+ 18:19   0:05 dolphin
sayan      31560  0.5  2.3 1220692 186412 ?      Ssl 18:22   0:09 konsole
sayan      67569  5.5  2.3 1383400 183608 ?      Sl   18:48   0:00 kioslave5
→ linux git:(master) ✘
```

head - limits output to only first 10 lines

# Write programs to work together

---

```
→ linux git:(master) ✘ ps auxc --sort=-rss | head | grep -P ".*\d\d:.."  
sayan      8936 31.1  4.0 1188025768 320260 ?  Rl  18:07 21:52 chrome  
→ linux git:(master) ✘
```

grep – Global/REgex/Print – finds patterns in text

# Write programs to work together

---

```
→ linux git:(master) ✘ ps auxc --sort=-rss | head | grep -P ".*\d\d:.."  
| awk '{print $NF}'  
chrome  
→ linux git:(master) ✘
```

awk – a powerful stream manipulation tool

# Everything is file!?

---

In \*nix systems, everything is a text or binary file or stream

- Files
- Devices
- Processes

# Everything is file!?

---

```
→ linux git:(master) ✘ cat linux.pre
$ Introduction to Linux and Unix Philosophy

# Linux
Created by Linus Torvalds while still in college.
It was the missing piece (kernel) to the puzzle
of Free and Open Source Operating System along
with the GNU coreutils created by Richard Stallman.

!linus.jpg
Linus Torvalds – creator of Linux Kernel

!rms.jpg
Richard Stallman (RMS) – creator of GNU, and GPL

# Unix Philosophy
– Originated by Ken Thompson
– Set of cultural norms and philosophical approaches to
– minimal, modular, and SIMPLE software

# Unix Philosophy
– Do one thing and do it well
– Write programs to work together
– Work primarily on text streams, as it is a universal interface

# Do one thing, Do it well
Almost all of GNU and Unix coreutils are very simple
and modular. They do one thing and do it well.

# Do one thing, Do it well
!df.png
df – reports disk filesystem space usage
```

This presentation(pdf) was made using a text file

# Everything is file!?

---

```
→ linux git:(master) × ll /dev/sd*
brw-rw---- 1 root disk 8,  0 Jul 25 18:02 /dev/sda
brw-rw---- 1 root disk 8,  1 Jul 25 18:02 /dev/sda1
brw-rw---- 1 root disk 8,  3 Jul 25 18:02 /dev/sda3
brw-rw---- 1 root disk 8, 16 Jul 25 18:02 /dev/sdb
brw-rw---- 1 root disk 8, 17 Jul 25 18:02 /dev/sdb1
brw-rw---- 1 root disk 8, 18 Jul 25 18:02 /dev/sdb2
brw-rw---- 1 root disk 8, 19 Jul 25 18:02 /dev/sdb3
brw-rw---- 1 root disk 8, 20 Jul 25 18:02 /dev/sdb4
→ linux git:(master) × █
```

All storage devices (and other hardware) are also files

# Everything is file!?

---

```
→ linux git:(master) ✘ ls /proc
1    12786 160   2208  26557 3395 49   571  609  71   79   85229 94   driver      mounts
101  12787 1606  222  26558 34   5   572  61   714  79254 85346 943  dynamic_debug mtrr
1016 12803 1655  22226 26725 3418 50   573  610  72   80   857   946  execdomains net
1018 13    1672  22249 26739 3428 502  574  611  73   81   863   95   fb          pagetypeinfo
1019 14    1684  22275 268   3457 509  577  612  730  813  86707 958  filesystems partitions
1025 1453 16946 223   269   34980 510  58   613  74   81426 869   959  fs          pressure
1031 1458 1698   23   27   35   517  582  63   741  81706 871   96   interrupts  schedstat
1045 1477 17    23146 2780 36   52   59   639  74781 82    883   967  iomem       scsi
1058 1482 1709  23231 28   37   520  592  64   75   83    887   974  ioports     self
1059 1483 1721  2329 29   4    526  593  641  754  83107 89216 99   irq         slabinfo
1060 1485 1723  2343 3    40   53   594  647  759  83384 89218 89217 acpi      kallsyms
1062 1487 1795  24   30   41   538  595  65   759  83385 8924   bootconfig keys
108   1493 18    2458 30174 41130 54   599  653  76   83385 8924   buddyinfo  key-users
109   1494 19    2480 308   41131 542  6   6547  76428 83905 8936   bus        kmsg
1097 1495 19961 249   309   42   55   60   6564  76440 84    8944   config.gz config.gz
11    1498 2    2493 31    42157 558  600  66   7689  840   9    cgroups   kpagecgroup
111   15    20   25   31560 43    560  601  67   7690  84788 901   cmdline   kpagecount
1158 1521 21    250   31575 44   562  602  679  7699  84890 903   config.gz kpageflags
1167 1526 214   251   32354 45161 564  603  68   77    85   914   consoles  latency_stats
1199 1528 2143  2517 325   46   565  604  69   77172 85059 92   cpuinfo   loadavg
1224 1568 215   252   3362 46912 566  605  70   772   85073 93   crypto    locks
12716 1586 2176  25205 3366 47   569  606  704  778   85074 930  devices  meminfo
12717 1587 2187  254   3367 48   57   607  706  78    85091 931  diskstats misc
12737 16    22   26507 3369 482  570  608  707  785   85220 938  dma      modules
                                         938   dma      zoneinfo
→ linux git:(master) ✘ cat /proc/8936/cmdline
/opt/google/chrome/chrome --type=renderer --crashpad-handler-pid=1485 --enable-crash-reporter=, --change-stack-guard-on-fork=
enable --lang=en-US --num-raster-threads=2 --enable-main-frame-before-activation --renderer-client-id=66 --time-ticks-at-unix
--epoch=-1690288328165010 --launch-time-ticks=334237643 --shared-files=v8_context_snapshot_data:100 --field-trial-handle=0,i,1
3630051378994071782,11175456809047971568,262144 --enable-features=WebUIDarkMode%
→ linux git:(master) ✘
```

All processes are files! Remember chrome?

# Everything is file!?

---

```
→ linux git:(master) ✘ cat /sys/class/leds/input4::capslock/brightness  
0  
→ linux git:(master) ✘ cat /sys/class/leds/input4::numlock/brightness  
1  
→ linux git:(master) ✘ █
```

even the keyboard LEDs are files!

Theres much more to linux...

Thank you