

Linux

Diego Pacheco

About Me



- ❑ Cat's Father
- ❑ Principal Software Architect
- ❑ Agile Coach
- ❑ SOA/Microservices Expert
- ❑ DevOps Practitioner
- ❑ Speaker
- ❑ Author

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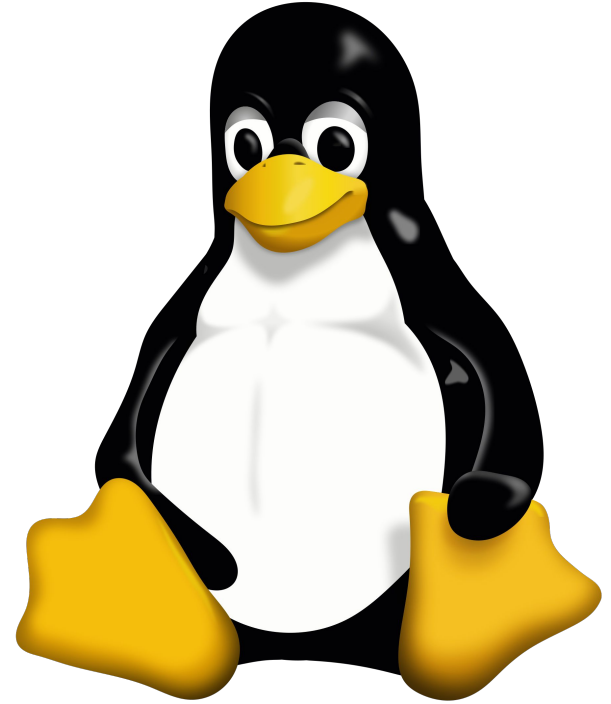
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Linux



Linus Torvalds



TUX - 1991

Linux vs Windows

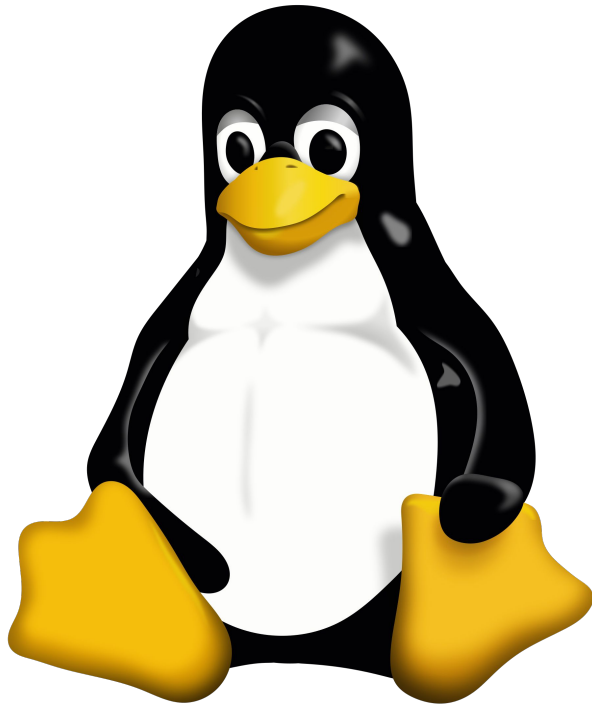


VS.



Microsoft  Linux

Linux



- ❑ FOSS
- ❑ Everything runs in Linux: PRODUCTION.
- ❑ Super Stable
- ❑ Cloud Vendors
- ❑ Software is MADE for LINUX.
- ❑ Linux is the BASE for DevOps Engineering
- ❑ Best way to learn is using it.
- ❑ Distributions
 - ❑ Ubuntu
 - ❑ CentOS / Amazon Linux
 - ❑ RHEL
 - ❑ ...

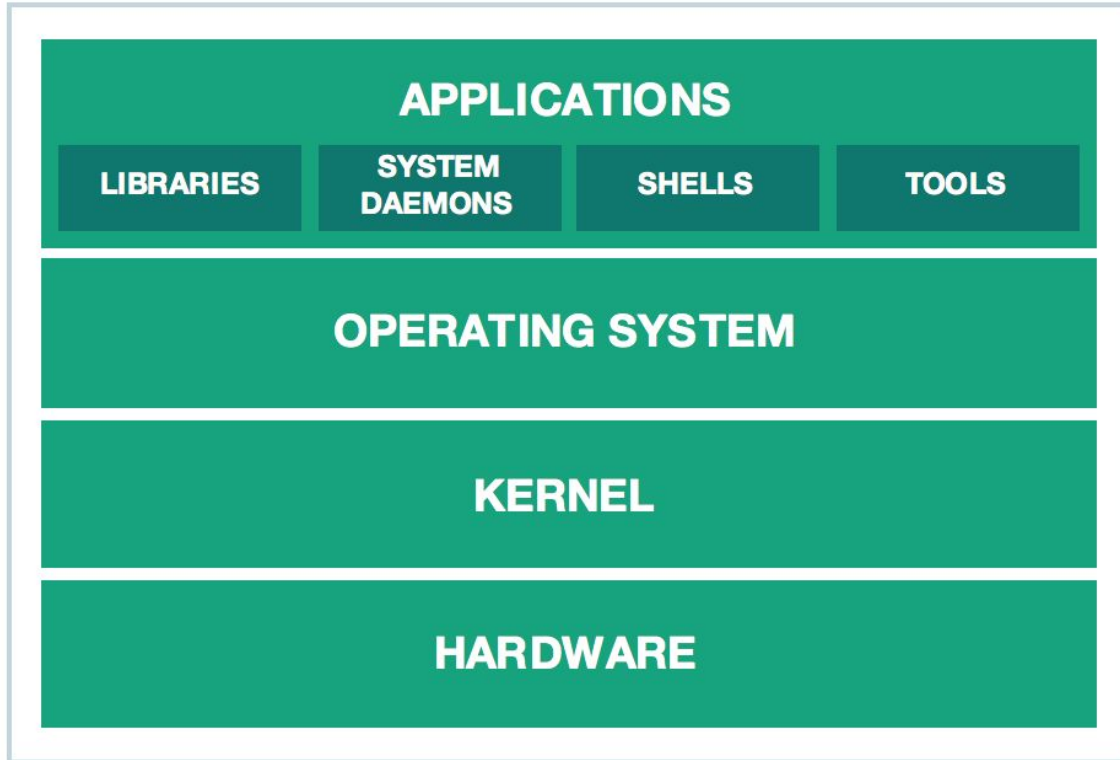
The diagram illustrates the lineage of Linux distributions from 1991 to 2008. The timeline is divided into three main branches, each representing a different lineage of Linux distributions.

- Debian/Ubuntu Lineage (Top):**
 - Debian:** Founded in 1993, it is the root of this lineage.
 - Ubuntu:** Founded in 2004, it is a derivative of Debian.
- Slackware/SuSE/openSUSE Lineage (Middle):**
 - Slackware:** Founded in 1993, it is the root of this lineage.
 - SuSE:** Founded in 1994, it is a derivative of Slackware.
 - openSUSE:** Founded in 2004, it is a derivative of SuSE.
- Red Hat/CentOS/Fedora Lineage (Bottom):**
 - Red Hat:** Founded in 1994, it is the root of this lineage.
 - CentOS:** Founded in 2004, it is a derivative of Red Hat.
 - Fedora:** Founded in 2003, it is a derivative of Red Hat.

The diagram also includes logos for each distribution: Debian (a stylized 'D'), Ubuntu (a red circle with a white 'U'), Slackware (a blue 'S'), SuSE (a green 'S'), openSUSE (a green 'S'), Red Hat (a red 'R'), CentOS (a colorful 'C'), and Fedora (a blue 'F').

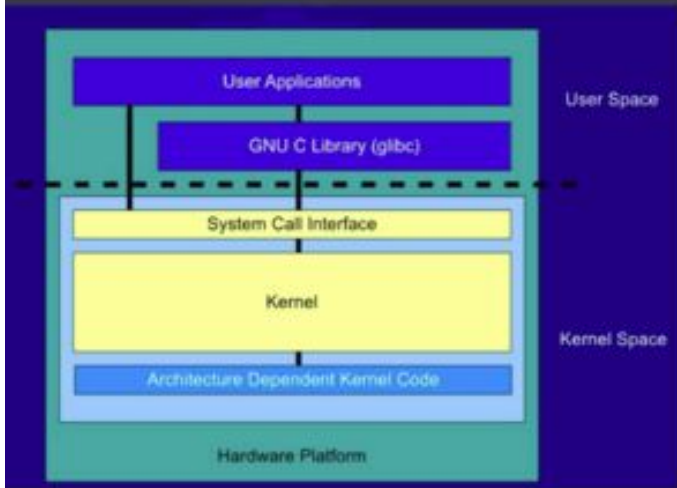


Linux Architecture



Isolation

KERNEL VS. USER SPACE



- * **User space** restricts user programs so that they can't accidentally mess with the system.
- * **Kernel space** is privileged and has full access to memory and resources.

/ "ROOT"

/BIN "ESSENTIAL BINARIES"

CAT
CHGRP
CHMOD
CHOWN
CP
DATA
DD
DF
DMESG
ECHO
FALSE
HOSTNAME
KILL
LN
LOGIN
LS
MKDIR
MKNOD
MORE
MOUNT
MV
PS
PWD
RM
RMDIF
SED
SH
STTY
SU
SYNCH
TRUE
UMOUNT
UNAME

/BOOT "STATIC FILES OF BOOT LOADER "

KERNEL
SYSTEM.MAP
VMLINUZ
INITRD
GRUB
MODULE.INFO
BOOT

/ETC "HOST SPECIFIC SYSTEM CONFIG"

CSH.LOGIN
EXPORTS
FSTAB
FTPUSERS
GATEWAYS
GETTYDEFS
GROUP
HOST.CONF
HOSTS
HOSTS.ALLOW
HOSTS.DENY
HOSTS.EQUIV
HOSTS.LPD
INETD.CONF
INITTAB
ISSUE
LS.SO.CONF
MOTD
MTAB
MTOOLS
NETWORKS
PASSWD
PRINTCAP
PROFILE
PROTOCOLS
RESOLV.CONF
RPC
SECURETTY
SERVICES
SHELLS
SYSLOG.CONF

/OPT

" CONFIG FILE
FOR ADD ON
APPLICATION
SOFTWARE "

/USR " SHAREABLE AND READ-ONLY DATA "

/LOCAL

"LOCAL
SOFTWARE"

/BIN
/GAMES
/INCLUDE
/LIB
/MAN
/SBIN
/SHARE
/SRC

/SHARE

" STATIC DATA
SHAREABLE
AMONG ALL
ARCHITECTURES "

/MAN

"MANUAL PAGES"

/MAN1 "user programs"
/MAN2 "system calls"
/MAN3 "lib functions"
/MAN4 "special file"
/MAN5 "file formats"
/MAN6 "games"
/MAN7 "misc."
/MAN8 "system admin."

/BIN

"MOST USER COMMANDS"

/INCLUDE

"STANDARD INCLUDE
FILES FOR 'C' PROG."

/LIB

" OBJ , BIN , LIB
FILES FOR PROG.
AND PACKAGES "

/SBIN

"NON ESSENTIAL
BINARIES"

/VAR "VARIABLE DATA FILES"

/CACHE

"APPLICATION
CACHE DATA"

/LIB

" VARIABLE STATE
INFORMATION
REMAINS AFTER
REBOOT "

/YP

" DATA FOR
NIS SERVICES "

/LOCK

"LOCK FILES FOR
SHARED RESOURCES"

/OPT

" VARIABLE DATA OF
PACKAGES INSTALLED"

/RUN

"INFO OF SYSTEM
SINCE IT WAS BOOTED"

/TMP

"AVAILABLE FOR PROG."

/SPOOL

"DATA AWAITING
PROCESSING "

/LPD

/MQUEUE

/NEWS

/RWHO

/UUCP

/LOG

"LOG FILES
AND DIR"

LASTLOG
MESSAGES
WTMP

/SBIN "SYSTEM BINARIES"

FASTBOOT
FASTHALT
FDISK
FSCK
GETTY
HALT
IFCONFIG
INIT
MKFS
MKSWAP
REBOOT
ROUTE
SWAPON
SWAPOFF
UPDATE

/TMP

"TEMPERORY FILES
DELETED ON BOOTUP"

/DEV

"LOCATION OF SPECIAL
OR DEVICE FILES
[CONTAINS MAKEDEV]"

/HOME

" USER HOME
DIRECTORIES"

/LIB

" LIBRARY AND
KERNEL MODULES"

/MNT

" MOUNT FILES
FOR TEMPORARY
FILESYSTEMS "

/OPT

" ADD-ON APPLICATION
SOFTWARE "

/ROOT

"HOME DIR. FOR
ROOT USER"

Permissions

```
# ls -l file
-rw-r--r-- 1 root root 0 Nov 19 23:49 file
```

File type

Owner (rw-)

Group (r- -)

Other (r - -)

r = Readable
w = Writeable
x = Executable
- = Denied

Permissions

4 2 1

0	-	-	-	no permissions
1	-	-	x	only execute
2	-	w	-	only write
3	-	w	x	write and execute
4	r	-	-	only read
5	r	-	x	read and execute
6	r	w	-	read and write
7	r	w	x	read, write and execute

Owner

rwx

$4+2+1$

7

Group

r-x

$4+0+1$

5

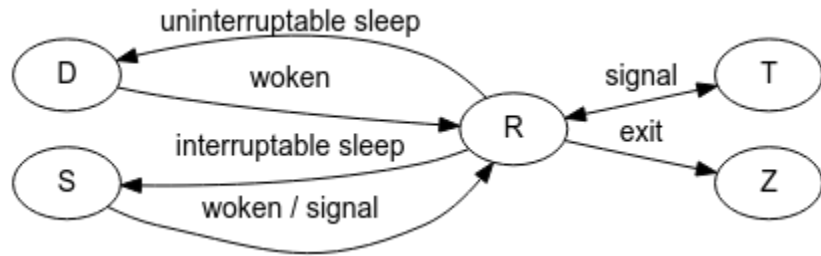
Other

r-x

$4+0+1$

5

Process



An amazing directory:

/proc

Every process on Linux has a PID (like 42). In `/proc/42`, there is a lot of **VERY USEFUL** information about process 42!

`/proc/42/env`

Here live all of the process's environment variables!

`/proc/42/fd`

"fd" stands for "file descriptor". Here you'll find links to all open files!

`/proc/42/cmdline`

The command line arguments it was started with!

AND MORE: look at `man proc`

```
diego@4winds ~$ ps aux | head
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1   0.0   0.0 225912  9712 ?        Ss   dez18    1:32 /sbin/init splash
root         2   0.0   0.0      0     0 ?        S    dez18    0:00 [kthreadd]
root         4   0.0   0.0      0     0 ?        I<   dez18    0:00 [kworker/0:0H]
root         6   0.0   0.0      0     0 ?        I<   dez18    0:00 [mm_percpu_wq]
root         7   0.0   0.0      0     0 ?        S    dez18    0:09 [ksoftirqd/0]
root         8   0.1   0.0      0     0 ?        I    dez18   17:53 [rcu_sched]
root         9   0.0   0.0      0     0 ?        I    dez18    0:00 [rcu_bh]
root        10   0.0   0.0      0     0 ?        S    dez18    0:00 [migration/0]
root        11   0.0   0.0      0     0 ?        S    dez18    0:02 [watchdog/0]
```

Services

```
diego@4winds ~$ ls /etc/init.d/
acpid      bluetooth  dbus       kerneloops  mdadm       plymouth-log  saned      ufw
alsa-utils cgrouppfs-mount dns-clean  keyboard-setup.sh  mdadm-waitidle  pppd-dns      screen-cleanup  unattended-upgrades
anacron    console-setup.sh  docker     kmod         networking    procs         speech-dispatcher  uidd
apparmor   cron            gdm3       lightdm      network-manager  redis-server  spice-vdagent   virtualbox
apport     cryptdisks      grub-common  lm-sensors   nfs-common     resolvconf    sysstat        vpnagentd
atd        cryptdisks-early  hddtemp     lvm2         nfs-kernel-server  rpcbind      thermald        warsaw
avahi-daemon  cups          hwclock.sh  lvm2-lvmetad  openbsd-inetd    rsync         ubuntu-fan      whoopsie
binfmt-support  cups-browsed  irqbalance  lvm2-lvmpolld  plymouth        rsyslog       udev            x11-common

diego@4winds ~$
```

```
diego@4winds ~$ service cron status
● cron.service - Regular background program processing daemon
   Loaded: loaded (/lib/systemd/system/cron.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2018-12-18 12:42:04 -02; 1 weeks 0 days ago
     Docs: man:cron(8)
    Main PID: 1244 (cron)
      Tasks: 1 (limit: 4915)
   CGroup: /system.slice/cron.service
           └─1244 /usr/sbin/cron -f

dez 26 12:15:01 4winds CRON[31933]: pam_unix(cron:session): session closed for user root
dez 26 12:17:01 4winds CRON[32258]: pam_unix(cron:session): session opened for user root by (uid=0)
dez 26 12:17:01 4winds CRON[32259]: (root) CMD ( cd / && run-parts --report /etc/cron.hourly)
dez 26 12:17:01 4winds CRON[32258]: pam_unix(cron:session): session closed for user root
dez 26 12:25:01 4winds CRON[981]: pam_unix(cron:session): session opened for user root by (uid=0)
dez 26 12:25:01 4winds CRON[982]: (root) CMD (command -v debian-sal1 > /dev/null && debian-sal1 1)
dez 26 12:25:01 4winds CRON[981]: pam_unix(cron:session): session closed for user root
dez 26 12:35:01 4winds CRON[3553]: pam_unix(cron:session): session opened for user root by (uid=0)
dez 26 12:35:01 4winds CRON[3554]: (root) CMD (command -v debian-sal1 > /dev/null && debian-sal1 1)
dez 26 12:35:01 4winds CRON[3553]: pam_unix(cron:session): session closed for user root
```


Package Managers



- ❑ APT for Ubuntu
- ❑ YUM for CentOS
- ❑ Lists of verified software
- ❑ Easy to install and maintain
- ❑ Often don't have the latest versions
- ❑ You can provide additional sources/lists.

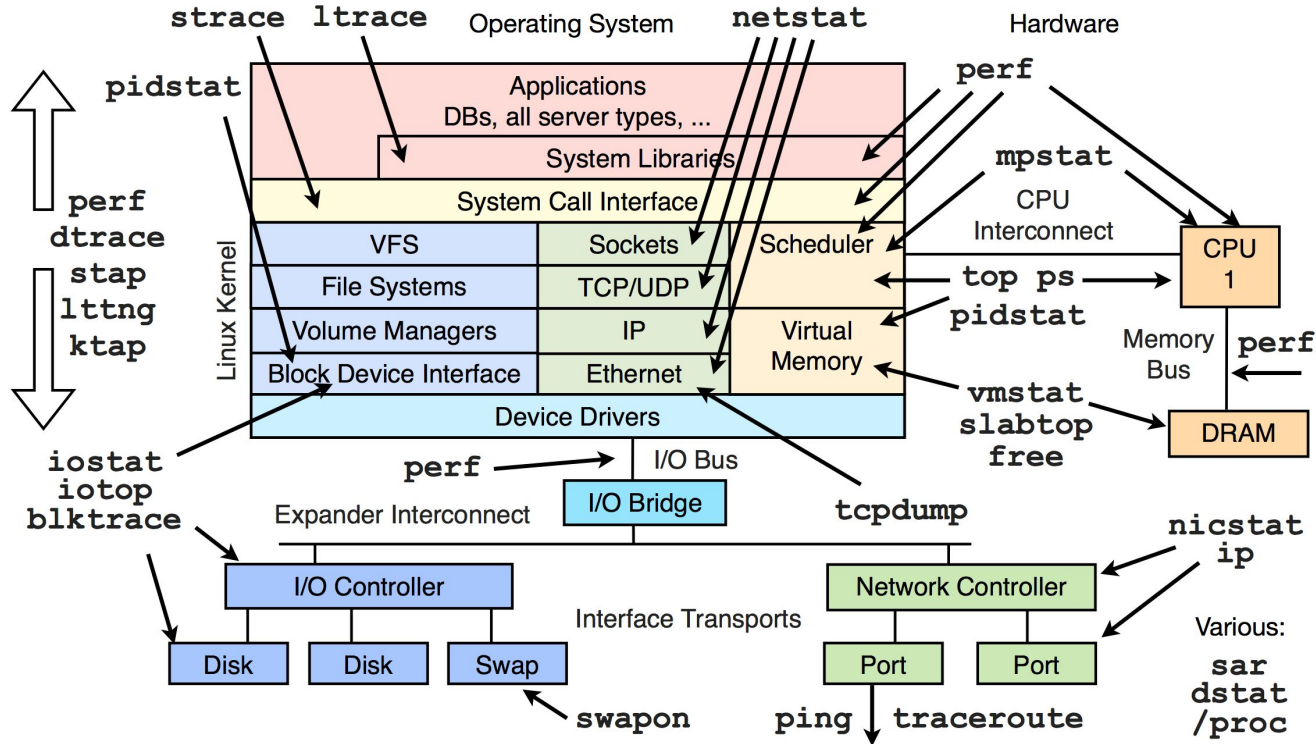
Compiling -GCC

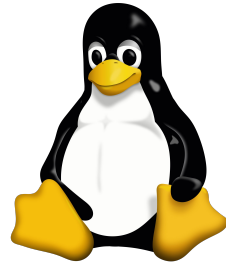


- ❑ Linux Compiler for C
- ❑ Often you need compile software
- ❑ Allow you to get the latest versions
- ❑ However you need to install dependencies
- ❑ Often used with Makefiles
- ❑ Easy to use
- ❑ Slow Sometimes

```
./configure  
make  
make install
```


Linux Observability





Linux

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