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Introduction to the Linux OS

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Users and Groups

Users and Groups:

- /etc/passwd: users configutation: home, shell, title, uid
- /etc/shadow: users password hash
- /etc/groups: groups

Superusers:

- su / sudo (-i)
- su needs further config to run graphical applications
- visudo
- separate home dir in /root

Processes in Linux

Running applications and system processes can be inspected, killed, ... (aka TaskManager in Windows)

- `ps axuf | less`: inspect currently running processes (one-time)
- `top`, `htop`: online inspection of processes
  - Frequency of update
  - Search
  - Sort by memory usage instead of CPU
  - Can kill or change priority of a process
- `kill, killall, xkill`: kill process or application
- `nice`, `renice`: change application priority (0 by default, only root can increase it)
  - Priorities: -20 ... 19
  - `nice -12 large-job`: run large-job with priority 12
  - `nice --12 large-job`: run large-job with priority -12
  - `renice 17 -p 1134`: change priority of process with id 1134 to 17
- `cpulimit`: limit cpu usage of a process
- `ulimit`, `unlimit`: limit resources for a process (resp. in active shell): e.g. memory, number of opened files, ...
  - User can't override defaults in `/etc/security/limits.conf`
  - `ulimit -a`: see current limits
  - `unlimit`: set limits to the system defaults (not further limits for user)
  - `ulimit -Sv`: limit memory usage in kilobytes

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GUI processes

- `xrestop`: GUI processes
- `xkill`: GUI kill
- `wmctrl`: Change GUI window position, size, etc.
- `xev`: Monitor / debug key press (special keys)
- `xprop`: Properties of GUI window
- `xdotool`: Properties of GUI window, including emulation of keyboard/mouse

Other resources monitoring

- `iotop`: Disk usage per process
- `jnettop`: Network usage

Administration

Power and Services

In general: search for solutions of problems e.g. at *stackoverflow.com*, but be careful advices include modification of system files (configs are OK; reshufling binaries, libraries etc. NOT)

- `shutdown`, `poweroff`, `halt`, `reboot`,
- `hibernate`, `hibernate-ram`, `hibernate-disk`, `s2disk`, `s2ram`
- `systemctl` command:
  - `list-units`: list running system services
  - `stop`, `start`, `restart`: handle given service, only works till restart
  - `disable`, `enable`: enable/disable service completely (even after restart)

System configuration:

- in `/etc` directory
- most common default options in `/etc/default` directory

Logging of system events: in `/var/log` directory

- `syslog`, `daemon.log`, `messages`, `kern.log`, `debug`: system messages
- `auth.log`: info about logging of users (including virtual ones)
- `Xorg.0.log`: log of the GUI system
- Log files are usually backuped per month and started freshly again (`/etc/logrotate.conf`, `/etc/logrotate.d`)

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Handled by the Linux Kernel (includes HW drivers)

- Info about HW in pseudofiles: `/dev/*`, `/sys/*`, `/proc`
- Commands to list HW:
  - `lspci`: HW connected to the PCI bus
  - `lshw`: detailed info about all HW
  - `lsusb`: USB devices
  - `lsblk`: Block devices (disks)
  - `lsscsi`: SCSI devices (CD/DVD)
- Adding removing driver (= kernel module):
  - `lsmod`: list loaded kernel modules
  - `modinfo`: detailed info about kernel module
  - `modprobe`: add, or remove (`-r`) from kernel
  - `insmod`, rmmod: simple add / remove module from kernel
  - PS: Not all drivers are as separated modules, but can be builtin in the kernel =¿ the only way to disable them is via kernel option in GRUB boot loader
- Configuring kernel modules:
  - `/etc/modules`: force load of kernel modules not picked up automatically (special HW, very new HW, ...)
  - `/etc/modprobe.d`: add options to drivers, blacklist drivers

Network

Nowadays most systems use *NetworkManager* (NM) application to handle the net connection

- `/sbin/ifconfig`: Show info about network devices and connection (IP address, MAC address)
- NM allows complex configuration, including scripts
- NM recently generates random WiFi MAC address for security on public sites: might need to be disabled in corporate networks through `/etc/NetworkManager` settings

Useful commands:

- `ping`: Check remote host is online
- `traceroute`: Show full communication path to remote host
- `ssh`: connect to remote host via Secure Shell
- `ftp, sftp, scp, nfs`: copy files from/to remote host (see later lectures)
- `netstat`: info about connections, opened ports etc. (`netstat -natulp | less`)

Print

The linux system mostly rely on CUPS printing system:

- `/etc/cups`: configuration of the print client and server
- `localhost:631` in web-browser: WEB-based configuration of CUPS

However, recently some GUI applications can ignore CUPS settings and search for available printers by themselves...

Automatic tasks in background

CRON system:

- /etc/crontab: basic file to run tasks per hour/day/week/month
- /etc/cron.hourly
- /etc/cron.daily
- /etc/cron.weekly
- /etc/cron.monthly
- /etc/cron.d: more complicated rules

```
# /etc/cron.d/renew_prak0x: crontab entries for reweval of the prak0x user home directories
# Execute only during the period of the exercises (01.Oct - 20.Jan)
# TODO ?: Add entry in between day in case of 2 excercises per single day

SHELL=/bin/bash

# m  h   dom   mon              dow  user  command
32   01   *    OCT,NOV,DEC,JAN  SUN  root  /home/prak_template/bin/reboot.cron.sh
# NO!!! (studenti by po rebootu nenasli sva data !)
#@reboot                            root  /home/prak_template/bin/renew_prak0x.cron.sh
12   03   *    OCT,NOV,DEC       *   root  /home/prak_template/bin/renew_prak0x.cron.sh
12   03  1-20  JAN               *   root  /home/prak_template/bin/renew_prak0x.cron.sh
```

Packages (Ubuntu/Debian based distibitions)

APT system to download and install packages from repositories

- `apt-get`, `aptitude`: commands to run the tasks (install, remove, update package list)
- `/etc/apt`: configuration of the packaging system
- Temporary files (package list, downloaded installation files) in `/var/lib/apt/lists` and `/var/cache/apt` files
- Dependencies are flagged as auto-installed (`/var/lib/apt/extended_states`
- Simulate action (complicated upgrades): `apt-get -s`

DPKG is used to handle already installed packages:

- `-i`: install local package
- `-r`/`-P`: remove/purge installed package (purge = remove also config files)
- Allows to install even conflicting packages (`--force-depends`, `--force-conflicts`): use with care !
- Packages can ask for configuration options during installation process, reinvoke these questions by `dpkg-reconfigure` command
- Packages can provide "alternatives" for similar tasks: `update-alternatives` command to handle these selections

Linux on net is also target of attacks, especially through the ssh connection

- `sshguard`: service that stops ssh login after several failed attempts
- `rkhunter`: complex check of the most important system utilities
- `chkrootkit`: simple check of most known "viruses" in the system utilities
- `logcheck`: scans log files and reports suspicious activities

Many of these commands are set to run regularly and send reports by e-mail to the system admin (see `/etc/aliases` file)