MODERN OPERATING SYSTEMS

LECTURE 11

AUTHOR: DR. ZVEREVA OLGA M.

AGENDA

- LINUX BOOT & STARTUP PROCESS
- FIRST ADMINISTRATIVE TASKS: USER ACCOUNT MANAGEMENT

LINUX BOOT & STARTUP PROCESSES (VERSION BIOS / MBR)

USUALLY IT CONSIDERED, THAT BOOT SEQUENCE STARTS WHEN THE COMPUTER IS TURNED ON, AND IS COMPLETED WHEN THE KERNEL IS INITIALIZED AND systemd (init) IS LAUNCHED. THE STARTUP PROCESS THEN TAKES OVER AND FINISHES THE TASK OF GETTING THE LINUX COMPUTER INTO AN OPERATIONAL STATE.

MAIN STAGES:

1. BIOS -> MBR
2. MBR-> LINUX LOADER (GRUB, GRUB2, LILO)
3. KERNEL INITIALIZATION
4. systemd (init) WORK

BIOS/MBR

- THE FIRST STEP OF THE LINUX BOOT PROCESS REALLY HAS NOTHING WHATEVER TO DO WITH LINUX. THIS IS THE HARDWARE PORTION OF THE BOOT PROCESS AND IS THE SAME FOR ANY OPERATING SYSTEM. WHEN POWER IS FIRST APPLIED TO THE COMPUTER IT RUNS THE POST (POWER-ON SELF TEST) WHICH IS PART OF THE BIOS (BASIC I/O SYSTEM).
- POST IS THE PART OF BIOS WHOSE TASK IS TO ENSURE THAT THE COMPUTER HARDWARE FUNCTIONED CORRECTLY. IF POST FAILS, THE COMPUTER MAY NOT BE USABLE AND SO THE BOOT PROCESS DOES NOT CONTINUE.
- IN ACCORDANCE TO BOOTABLE SEQUENCE STORED IN BIOS, THE FIRST BOOT SECTOR IT FINDS THAT CONTAINS A VALID BOOT RECORD IS LOADED INTO RAM AND CONTROL IS THEN TRANSFERRED TO THE CODE THAT WAS LOADED FROM THE BOOT SECTOR.

GRUB1 & GRUB2

1. GRUB2 STANDS FOR "GRAND UNIFIED BOOTLOADER, VERSION 2" AND IT IS NOW THE PRIMARY BOOTLOADER FOR MOST CURRENT LINUX DISTRIBUTIONS. GRUB2 IS THE PROGRAM WHICH MAKES THE COMPUTER JUST SMART ENOUGH TO FIND THE OPERATING SYSTEM KERNEL AND LOAD IT INTO MEMORY.
2. IF YOU HAVE MORE THAN 1 KERNEL, YOU CAN CHOOSE THE APPROPRIATE ONE (IF TIMEOUT IS VIOLATED WILL LOAD DEFAULT KERNEL)
3. GRUB KNOWS WHAT FILE SYSTEM IS (IS ABLE TO FIND FILE WITH KERNEL)
4. GRUB CAN BE CONFIGURED USING THE /boot/grub/grub.cfg FILE
5. THE PRIMARY FUNCTION OF EITHER GRUB IS TO GET THE LINUX KERNEL LOADED INTO MEMORY AND RUNNING. BOTH VERSIONS OF GRUB WORK ESSENTIALLY THE SAME WAY

NECESSARY TO KNOW

- EVERY HARDWARE DEVICE IS REPRESENTED IN LINUX AS A FILE LOCATED IN /dev
- ANY KIND OF WORK WITH COMPUTER HARDWARE IS REPRESENTED AS A WORK WITH THE DEFINITE FILE
- HARD DISK IS REPRESENTED BY THE FILE NAMED LIKE “HD (SD)” + LATIN LETTER:

  /dev/hda, /dev/hdb… /dev/sda, /dev/sdb…

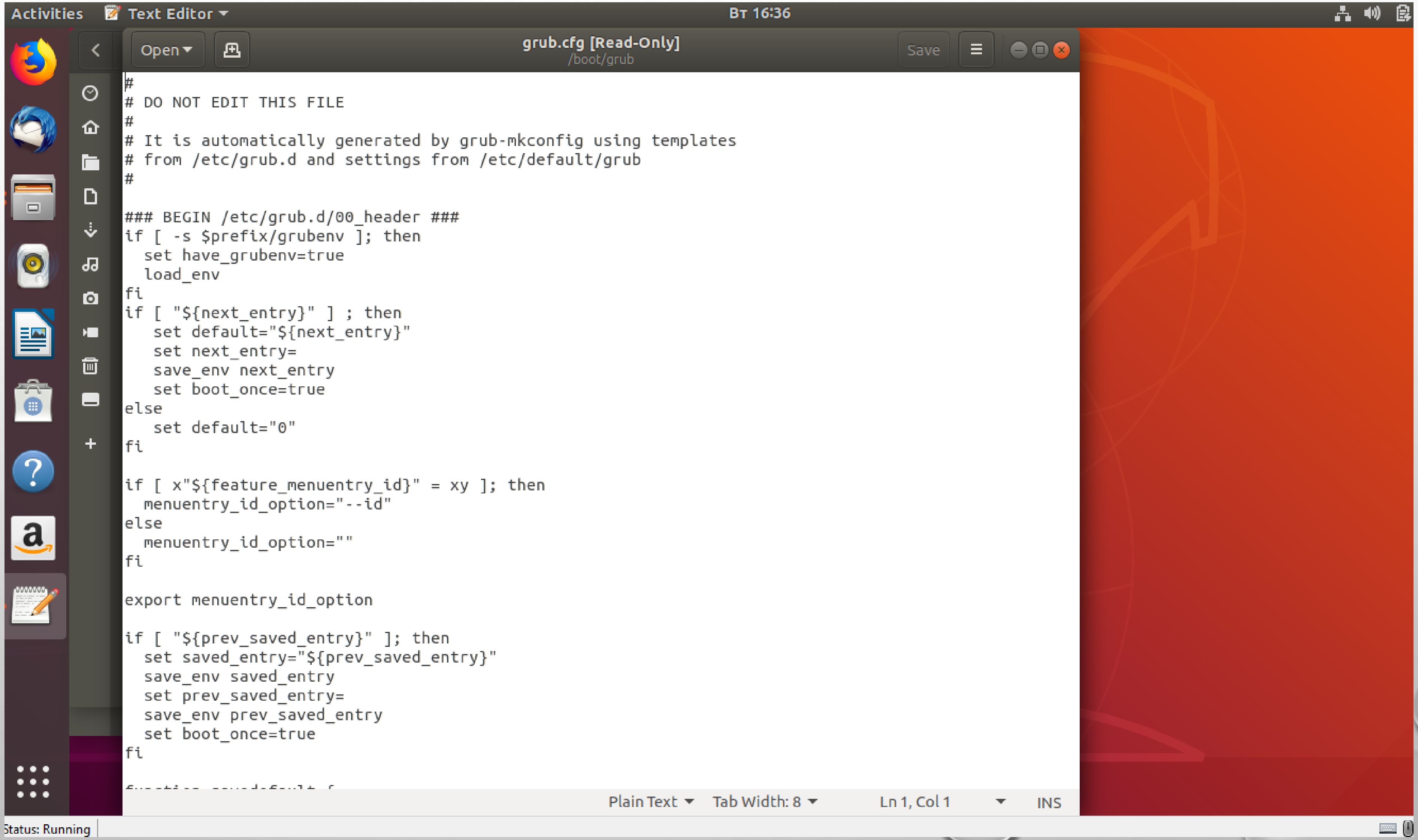
  Where:

  - ✓ hd (or sd) determine disk interface (type of controller) (hd – IDE/EIDE interface, sd– SCSI or SATA interface)
  - ✓ a, b, … - number of disk on the controller
- TO IDENTIFY A DISK PARTITION IT’S NECESSARY TO ADD POSITIVE INTEGER NUMBER TO THE DISK FILE NAME
  - ✓ EXAMPLE: /dev/sda1 (THE FIRST PARTITION OF THE FIRST HARD DISK ON SCSI (SATA) CONTROLLER)

PECULIARITIES OF grub.cfg

- COMPUTER DISKS ARE NUMERATED BY NATURAL NUMBERS (FROM 0 TO 64)
- DISK PARTITIONS MIGHT HAVE NUMBERS FROM 0
- THE GENERAL SYNTAX IS: (hd0, 0)

GRUB'S CONFIGURATION FILE (GRUB.CFG)



```
#
# DO NOT EDIT THIS FILE
#
# It is automatically generated by grub-mkconfig using templates
# from /etc/grub.d and settings from /etc/default/grub
#

### BEGIN /etc/grub.d/00_header ###
if [ -s $prefix/grubenv ]; then
  set have_grubenv=true
  load_env
fi
if [ "${next_entry}" ] ; then
   set default="${next_entry}"
   set next_entry=
   save_env next_entry
   set boot_once=true
else
   set default="0"
fi

if [ x"${feature_menuentry_id}" = xy ]; then
  menuentry_id_option="--id"
else
  menuentry_id_option=""
fi

export menuentry_id_option

if [ "${prev_saved_entry}" ]; then
  set saved_entry="${prev_saved_entry}"
  save_env saved_entry
  set prev_saved_entry=
  save_env prev_saved_entry
  set boot_once=true
fi

function savedefault {
```

ANOTHER GRUB.CFG VERSION (RED HAT)

```
DEFAULT=1
TIMEOUT=10
SPLASHIMAGE=(HD0,2) /BOOT/GRUB/FIG1X.XPM.GZ
FOREGROUND=23334C BACKGROUND=82A6BC
PASSWORD --MD5 $1$H8LLM1$CI0LFS5.C06XFJYPQ8IXZ/
TITLE RED HAT LINUX (2.4.20-31.9)
    ROOT (HD0,6)
    KERNEL /BOOT/VMLINUZ-2.4.20-31.9 RO ROOT=LABEL=RH9 HDD=IDESCSI
    INITRD /BOOT/INITRD-2.4.20-31.9.IMG
    SAVEDEFAULT
    BOOT
TITLE RED HAT ENTERPRISE LINUX WS A (2.4.21-40.EL)
    ROOT (HD0,10)
    KERNEL /BOOT/VMLINUZ-2.4.21-40.EL RO ROOT=LABEL=RHEL3 HDD=IDE-SCSI
    INITRD /BOOT/INITRD-2.4.21-40.EL.IMG
```

KERNEL

- ALL OF THE KERNELS ARE IN A SELF-EXTRACTING, COMPRESSED FORMAT TO SAVE SPACE. THE KERNELS ARE LOCATED IN THE /BOOT DIRECTORY, ALONG WITH AN INITIAL RAM DISK IMAGE, AND DEVICE MAPS OF THE HARD DRIVES.
- AFTER THE SELECTED KERNEL IS LOADED INTO MEMORY AND BEGINS EXECUTING, IT MUST FIRST EXTRACT ITSELF FROM THE COMPRESSED VERSION OF THE FILE BEFORE IT CAN PERFORM ANY USEFUL WORK.
- ONCE THE KERNEL HAS EXTRACTED ITSELF, IT LOADS systemd , WHICH IS THE MODERN REPLACEMENT FOR THE OLD SysV init PROGRAM, AND TURNS CONTROL OVER TO IT.

systemd VS. init

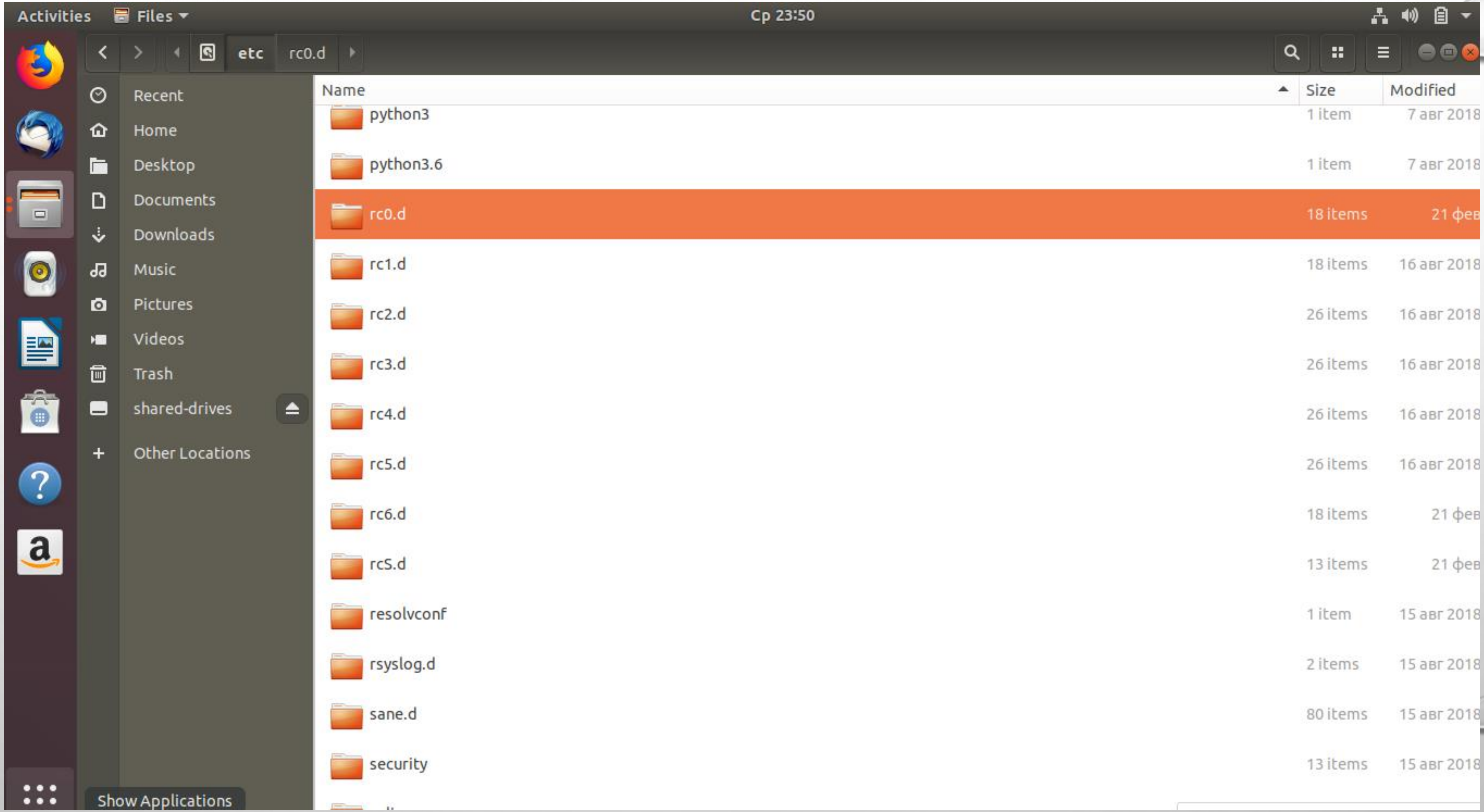
- THERE ARE TWO SCHEMES OF THE NEXT STARTUP STAGES: NEW VERSION – WITH “systemd” PROCESS AND “target*” FILES, AND OLDER VERSION – WITH “init” PROCESS AND RUNLEVELS.
- Systemd (init) IS THE MOTHER OF ALL PROCESSES. IT IS RESPONSIBLE FOR BRINGING THE LINUX HOST UP TO A STATE IN WHICH PRODUCTIVE WORK CAN BE DONE. THE MAIN FUNCTIONS ARE TO MANAGE MANY ASPECTS OF A RUNNING LINUX HOST, INCLUDING MOUNTING FILE SYSTEMS, AND STARTING AND MANAGING SYSTEM SERVICES REQUIRED TO HAVE A PRODUCTIVE LINUX HOST.
- FIRST, systemd (init) MOUNTS THE FILE SYSTEMS AS DEFINED BY **/etc/fstab**, INCLUDING ANY SWAP FILES OR PARTITIONS.
- AT THIS POINT, IT CAN ACCESS THE CONFIGURATION FILES LOCATED IN /etc, INCLUDING ITS OWN. IT USES ITS CONFIGURATION FILE, **/etc/systemd/system/default.target (/etc/inittab** – IN CASE OF SystemV init), TO DETERMINE THE STATE OR TARGET, INTO WHICH IT SHOULD BOOT THE HOST (IN init CASE – FILE “/etc/inittab”.
- TARGET (EARLIER RUNLEVEL) DETERMINES A SPECIFIC LEVEL OF FUNCTIONALITY, IN ANOTHER WORDS, IT SPECIFIES THE WORKPLACE OF THE CURRENT USER (WHETHER THEY WORK WITHOUT ANY GRAPHICS IN A TEXT MODE, OR EVEN IN A SINGLE USER MODE)
- THE **default.target** FILE IS ONLY A SYMBOLIC LINK TO THE TRUE TARGET FILE. FOR A DESKTOP WORKSTATION, THIS IS TYPICALLY GOING TO BE THE GRAPHICAL.TARGET, WHICH IS EQUIVALENT TO **RUNLEVEL 5** IN THE OLD SysV init.
- FOR A SERVER, THE DEFAULT IS MORE LIKELY TO BE THE **multi-user.target** WHICH IS LIKE **RUNLEVEL 3** IN SystemV.
- THE **emergency.target** IS SIMILAR TO SINGLE USER MODE.

COMPARISON OF SystemV RUNLEVELS WITH systemd TARGETS

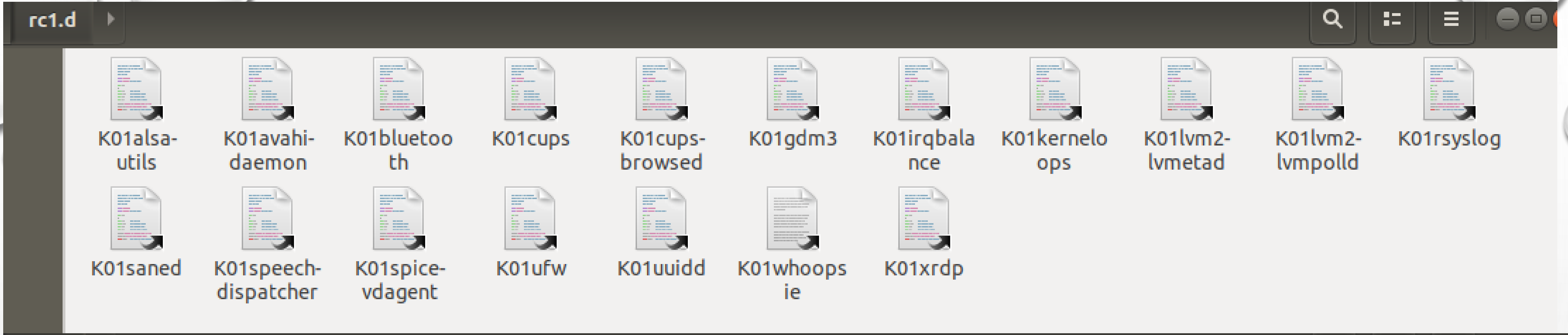
SystemV RUNLEVEL	systemd TARGET	DESCRIPTION
0	poweroff.target	Halts the system and turns the power off
1	rescue.target	A base system including mounting the file systems with only the most basic services running and a rescue shell on the main console
3	multi-user.target	All services running but command line interface (CLI) only
5	graphical.target	multi-user with a GUI.
6	reboot.target	Reboot

“init” AND RUNLEVELS VERSION

- ➢ BASED ON THE NECESSARY TO INSTALL RUNLEVEL (THE DEFAULT ONE OR CHOSEN WHILE THE STARTUP PROCESS) SYSTEM WILL USE FILES FROM THE FOLLOWING DIRECTORIES:
  - ✓ LEVEL 0 - /etc/rc0.d/
  - ✓ LEVEL 1 - /etc/rc1.d/
  - ✓ LEVEL 3 - /etc/rc3.d/
  - ✓ LEVEL 5 - /etc/rc5.d/
- ➢ IN THE /etc/rc*.d/ DIRECTORIES, THERE ARE SYMBOLIC LINKS WHICH BEGIN WITH LETTER “k” or “s”, THOSE LINKS STARTED WITH LETTER “k” RESULT IN “KILLING” THE PROCESS, STARTED WITH LETTER “s” RESULT IN “STARTING” THE PROCESS.
- ➢ THE NUMBER IN THE LINK NAME SHOWS THE ORDER OF THE LINKS IMPLEMENTING.

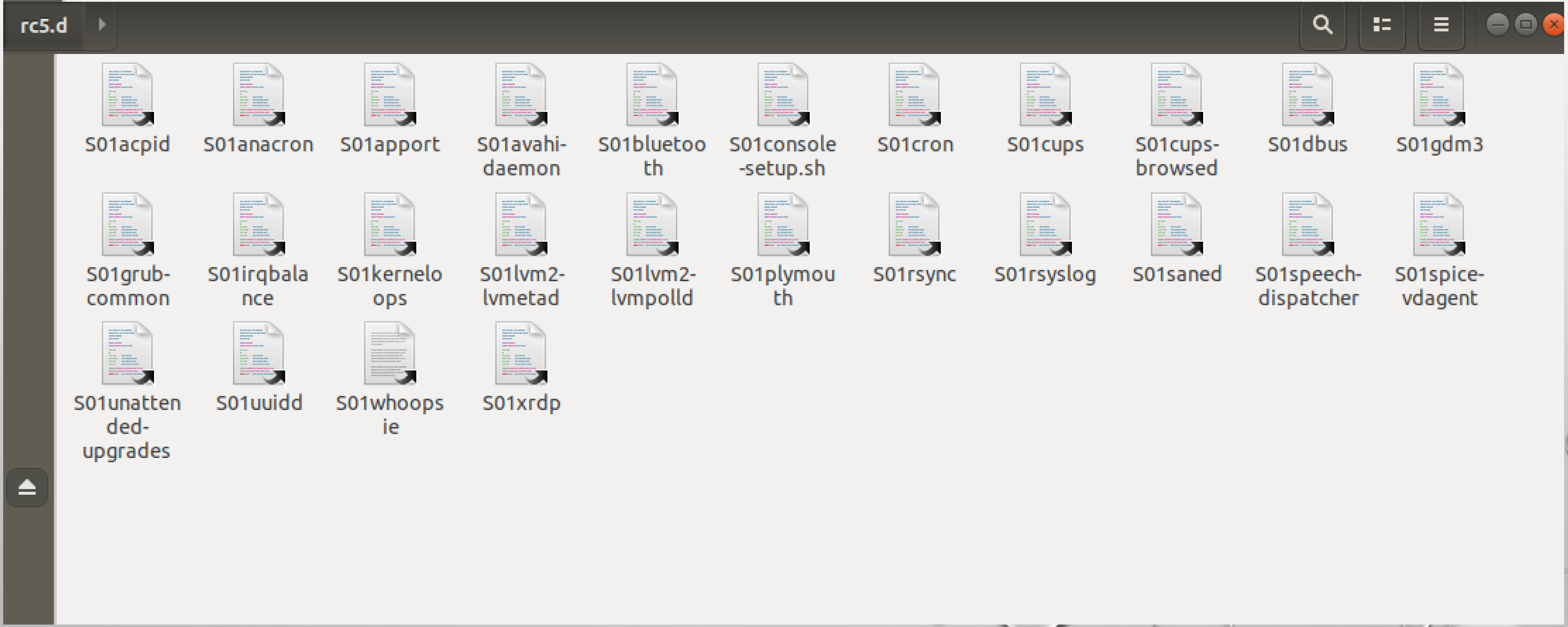


Name	Size	Modified
python3	1 item	7 авг 2018
python3.6	1 item	7 авг 2018
rc0.d	18 items	21 фев
rc1.d	18 items	16 авг 2018
rc2.d	26 items	16 авг 2018
rc3.d	26 items	16 авг 2018
rc4.d	26 items	16 авг 2018
rc5.d	26 items	16 авг 2018
rc6.d	18 items	21 фев
rcS.d	13 items	21 фев
resolvconf	1 item	15 авг 2018
rsyslog.d	2 items	15 авг 2018
sane.d	80 items	15 авг 2018
security	13 items	15 авг 2018



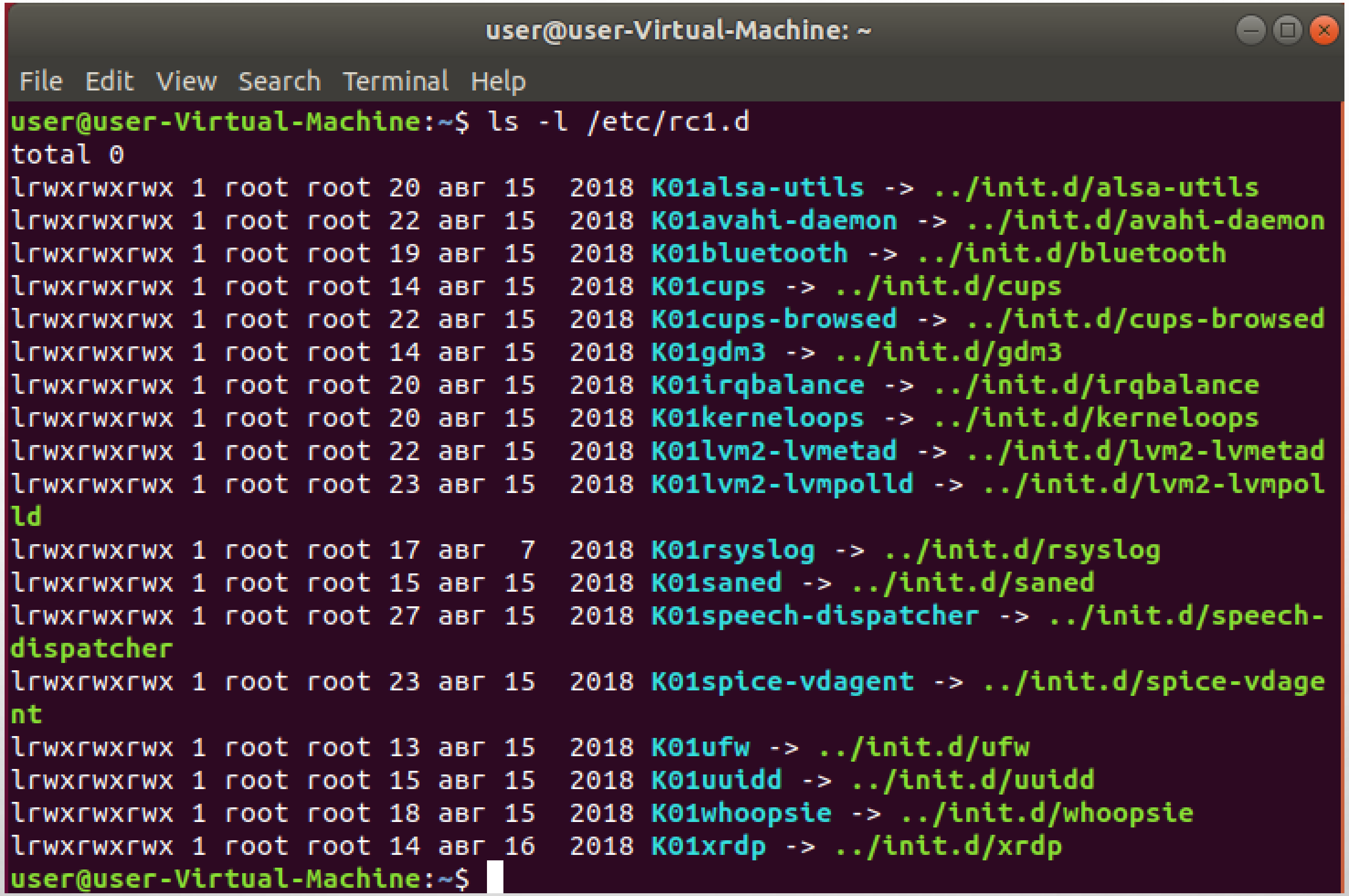
rc1.d

K01alsa-utils
K01avahi-daemon
K01bluetooth
K01cups
K01cups-browsed
K01gdm3
K01irqbalance
K01kernelops
K01lvm2-lvmetad
K01lvm2-lvmpolld
K01rsyslog
K01saned
K01speech-dispatcher
K01spice-vdagent
K01ufw
K01uuidd
K01whoopsie
K01xrdp



rc5.d

S01acpid
S01anacron
S01apport
S01avahi-daemon
S01bluetooth
S01console-setup.sh
S01cron
S01cups
S01cups-browsed
S01dbus
S01gdm3
S01grub-common
S01irqbalance
S01kernelops
S01lvm2-lvmetad
S01lvm2-lvmpolld
S01plymouth
S01rsync
S01rsyslog
S01saned
S01speech-dispatcher
S01spice-vdagent
S01unattended-upgrades
S01uuidd
S01whoopsie
S01xrdp

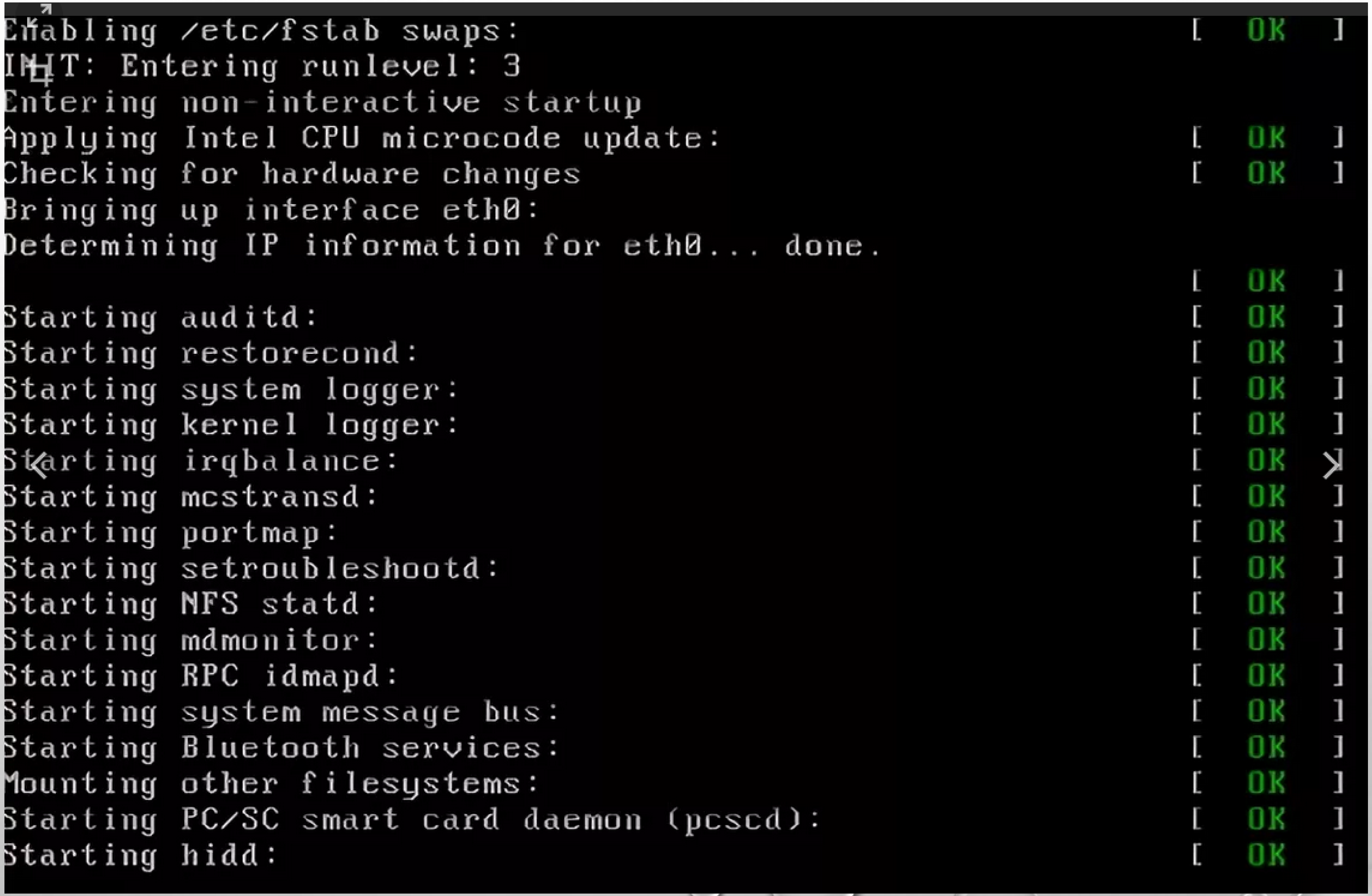

user@user-Virtual-Machine: ~
File Edit View Search Terminal Help

```
user@user-Virtual-Machine:~$ ls -l /etc/rc1.d
total 0
lrwxrwxrwx 1 root root 20 авг 15  2018 K01alsa-utils -> ../init.d/alsa-utils
lrwxrwxrwx 1 root root 22 авг 15  2018 K01avahi-daemon -> ../init.d/avahi-daemon
lrwxrwxrwx 1 root root 19 авг 15  2018 K01bluetooth -> ../init.d/bluetooth
lrwxrwxrwx 1 root root 14 авг 15  2018 K01cups -> ../init.d/cups
lrwxrwxrwx 1 root root 22 авг 15  2018 K01cups-browsed -> ../init.d/cups-browsed
lrwxrwxrwx 1 root root 14 авг 15  2018 K01gdm3 -> ../init.d/gdm3
lrwxrwxrwx 1 root root 20 авг 15  2018 K01irqbalance -> ../init.d/irqbalance
lrwxrwxrwx 1 root root 20 авг 15  2018 K01kerneloops -> ../init.d/kerneloops
lrwxrwxrwx 1 root root 22 авг 15  2018 K01lvm2-lvmetad -> ../init.d/lvm2-lvmetad
lrwxrwxrwx 1 root root 23 авг 15  2018 K01lvm2-lvmpolld -> ../init.d/lvm2-lvmpol
ld
lrwxrwxrwx 1 root root 17 авг  7  2018 K01rsyslog -> ../init.d/rsyslog
lrwxrwxrwx 1 root root 15 авг 15  2018 K01saned -> ../init.d/saned
lrwxrwxrwx 1 root root 27 авг 15  2018 K01speech-dispatcher -> ../init.d/speech-
dispatcher
lrwxrwxrwx 1 root root 23 авг 15  2018 K01spice-vdagent -> ../init.d/spice-vdage
nt
lrwxrwxrwx 1 root root 13 авг 15  2018 K01ufw -> ../init.d/ufw
lrwxrwxrwx 1 root root 15 авг 15  2018 K01uuidd -> ../init.d/uuidd
lrwxrwxrwx 1 root root 18 авг 15  2018 K01whoopsie -> ../init.d/whoopsie
lrwxrwxrwx 1 root root 14 авг 16  2018 K01xrdp -> ../init.d/xrdp
user@user-Virtual-Machine:~$
```

systemd VERSION

- EACH TARGET HAS A SET OF DEPENDENCIES DESCRIBED IN ITS CONFIGURATION FILE.
- SYSTEMD STARTS THE REQUIRED DEPENDENCIES.
- THESE DEPENDENCIES ARE THE SERVICES REQUIRED TO RUN THE LINUX HOST AT A SPECIFIC LEVEL OF FUNCTIONALITY.
- WHEN ALL OF THE DEPENDENCIES LISTED IN THE TARGET CONFIGURATION FILES ARE LOADED AND RUNNING, THE SYSTEM IS RUNNING AT THAT TARGET LEVEL.

LINUX BOOT SCREENSHOT



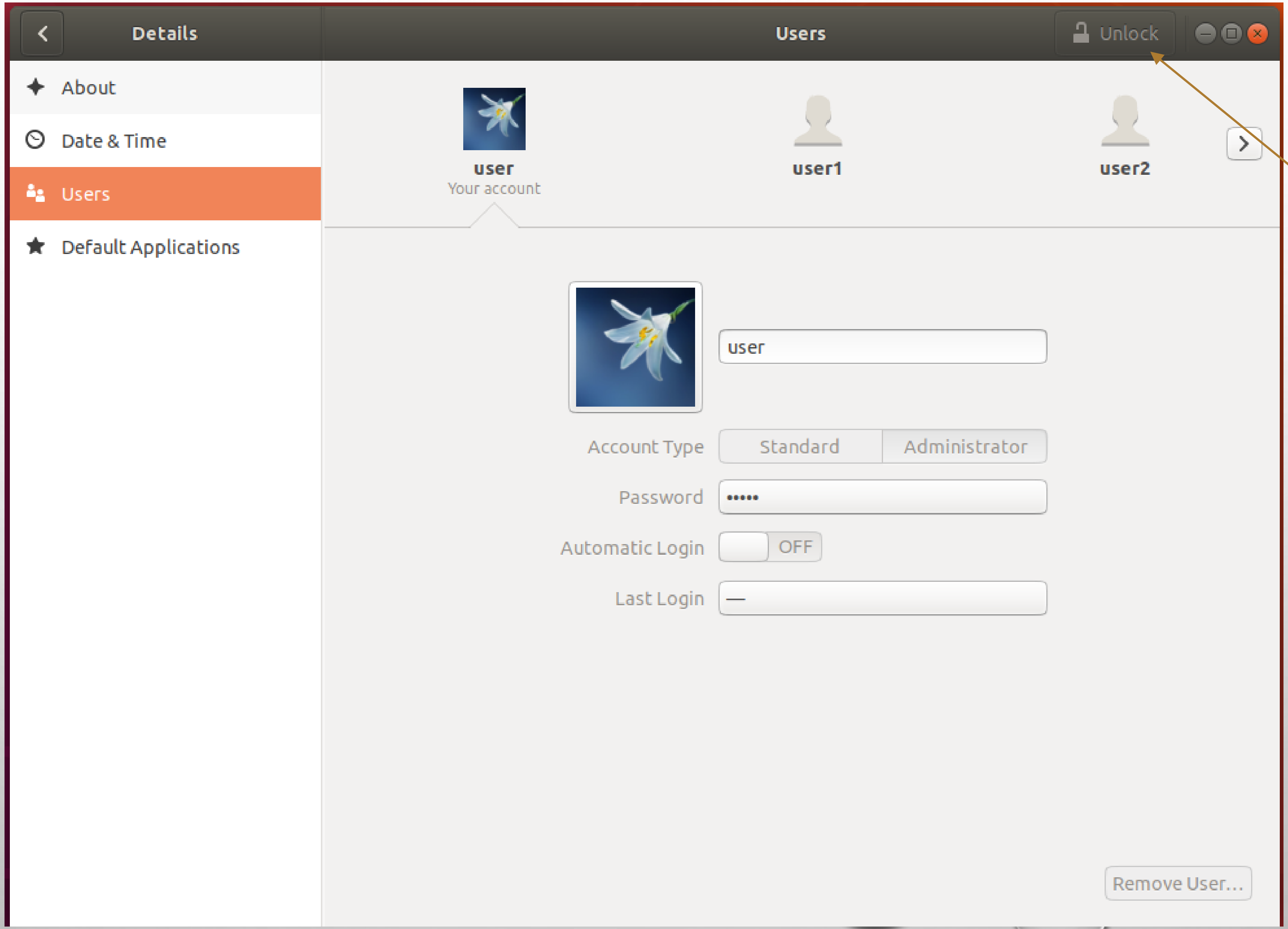
```
Enabling /etc/fstab swaps:                                        [  OK  ]
INIT: Entering runlevel: 3
Entering non-interactive startup
Applying Intel CPU microcode update:                              [  OK  ]
Checking for hardware changes                                     [  OK  ]
Bringing up interface eth0:
Determining IP information for eth0... done.
                                                                  [  OK  ]
Starting auditd:                                                  [  OK  ]
Starting restorecond:                                             [  OK  ]
Starting system logger:                                           [  OK  ]
Starting kernel logger:                                           [  OK  ]
Starting irqbalance:                                              [  OK  ]
Starting mcstransd:                                               [  OK  ]
Starting portmap:                                                 [  OK  ]
Starting setroubleshootd:                                         [  OK  ]
Starting NFS statd:                                               [  OK  ]
Starting mdmonitor:                                               [  OK  ]
Starting RPC idmapd:                                              [  OK  ]
Starting system message bus:                                      [  OK  ]
Starting Bluetooth services:                                      [  OK  ]
Mounting other filesystems:                                       [  OK  ]
Starting PC/SC smart card daemon (pcscd):                         [  OK  ]
Starting hidd:                                                    [  OK  ]
```

FIRST ADMINISTRATIVE TASKS: USER ACCOUNT MANAGEMENT

USERS IN SYSTEM

- ONE OF THE FIRST ADMINISTRATIVE TASKS IS TO CREATE USER ACCOUNT.
- IT CAN BE DONE IN A VARIETY OF WAYS:
  1. WITH THE HELP OF GUI
  2. FROM THE COMMAND LINE (IN TERMINAL)
  3. BY EDITING PARTICULAR CONFIGURATION FILES

1 ST OPTION: GUI (SETTINGS\USERS)



user

Account Type: Standard | Administrator

Password: •••••

Automatic Login: OFF

Last Login: —

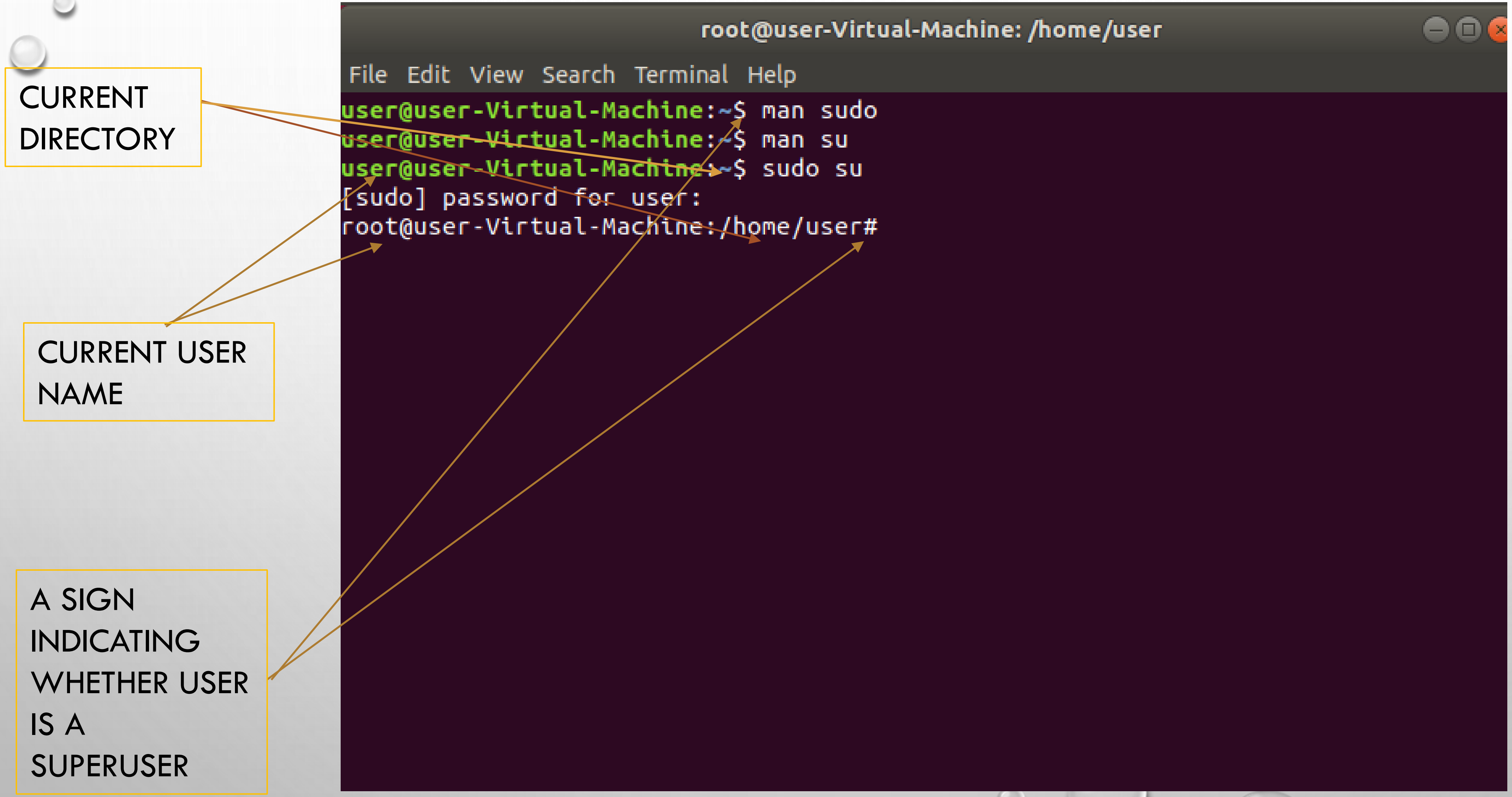
Necessary to unlock

sudo AND su

- In the early Linux versions there was a privileged user named “root” (like administrator in Windows), and all administrative tasks could have been done only under the name of this user. You must have logged in with root login, and do all the necessary administrative tasks. As usual, it was forbidden to log as root with graphical interface (only in text mode). Now, this concept is changed every user (especially the first one, having been created while system installation process) is able to carry out administrative tasks but they have to declare that they know that some operations could cause some damage. For this purpose, two commands (sudo and su) have been introduced almost in all Linux versions. Similar concept is realized in Windows as UAC (User Account Control).
- **sudo** – allows a permitted user to execute a command as a superuser. Often, according to security policy, it is necessary to type in user’s password (to authorize themselves) in order to be a success. This command has effect only on the succeeding **command** (i.e. sudo **command**)
- **su** – used to become another user during a login session
  - ✓ Syntax: su [options] [username]
  - ✓ EXAMPLE: su

  (to become superuser)
- Main difference – sudo has an effect on 1 commnd, su acts until the end of the session (or until another “su” command will be inputted).

TERMINAL'S WINDOW (COMMAND MODE)

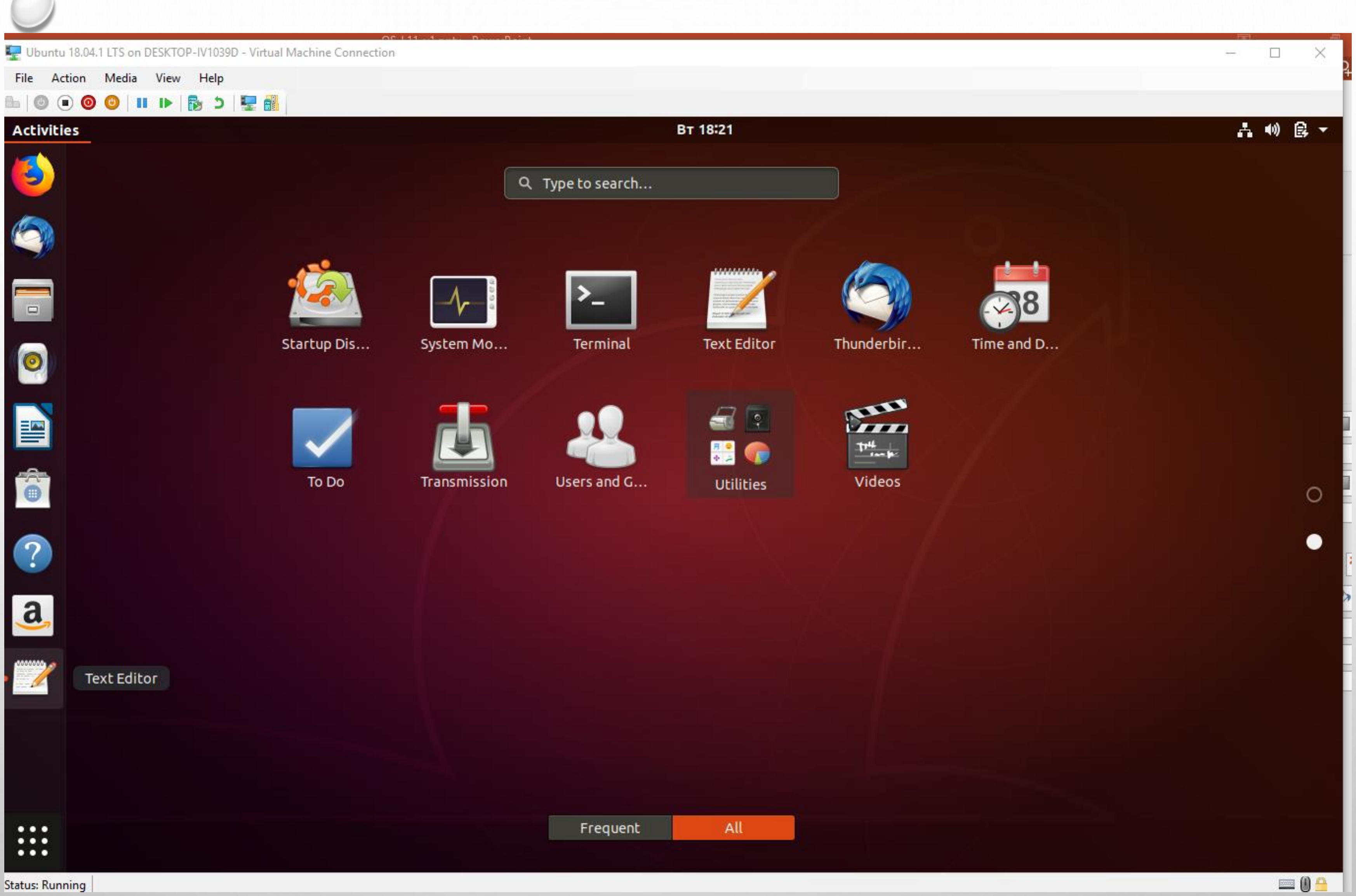

root@user-Virtual-Machine: /home/user
File Edit View Search Terminal Help
CURRENT DIRECTORY
CURRENT USER NAME
A SIGN INDICATING WHETHER USER IS A SUPERUSER

```
user@user-Virtual-Machine:~$ man sudo
user@user-Virtual-Machine:~$ man su
user@user-Virtual-Machine:~$ sudo su
[sudo] password for user:
root@user-Virtual-Machine:/home/user#
```

GUI: “USERS AND GROUPS”

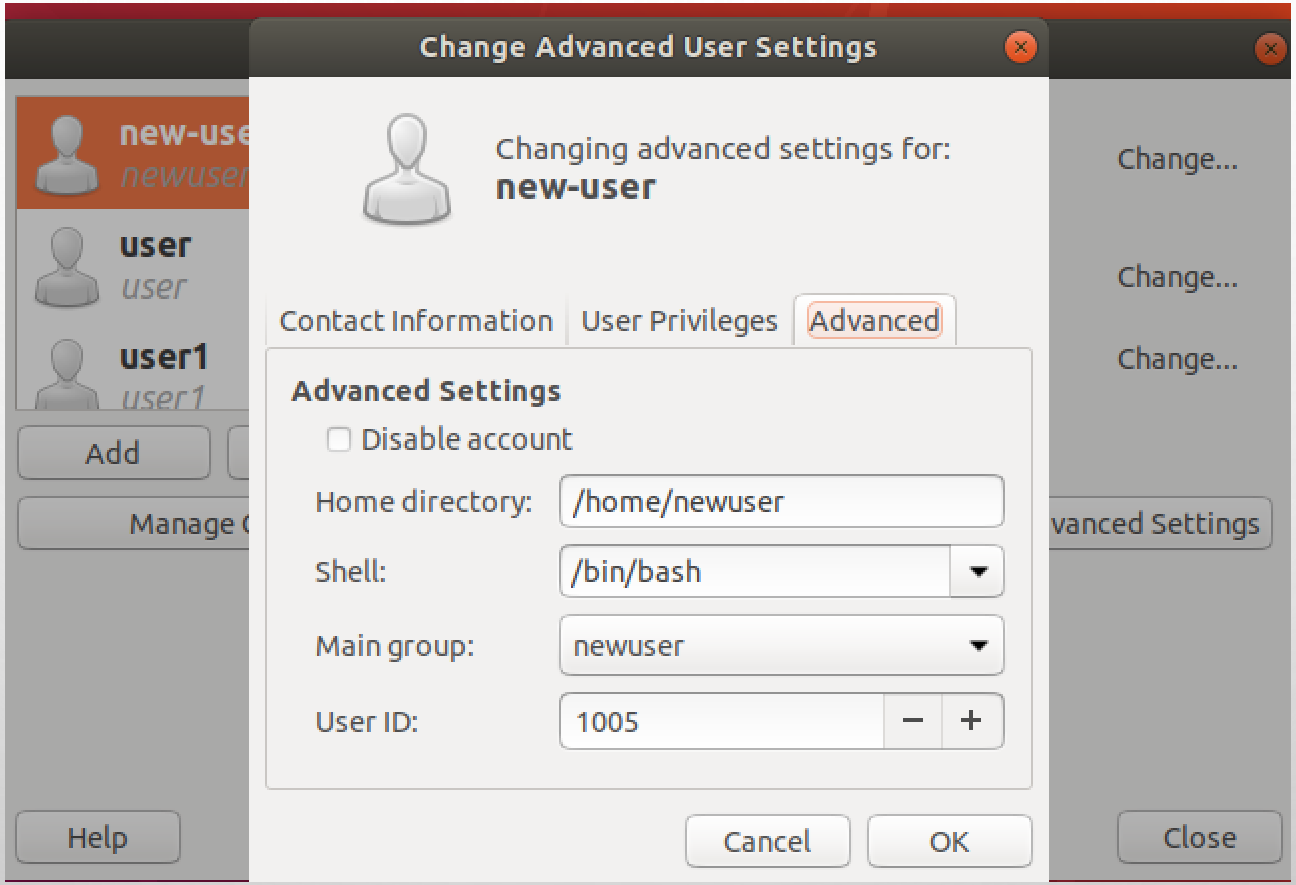
- THERE IS ANOTHER TOOL (“USERS AND GROUPS”, IT IS CONSIDERED TO BE DEPRECATED) TO MANAGE USERS (AND GROUPS). IT MIGHT BE NOT PREINSTALLED. TO WORK WITH IT, IT IS NECESSARY TO INSTALL ADDITIONAL PACKAGES. TO DO THIS THING, IT IS NECESSARY TO TYPE IN THE TERMINAL WINDOW:
  - ✓ sudo apt-get update
- ✓ sudo apt-get install gnome-system-tools

  (where **apt-get** is an installer of packages, “apt-get install” is a command for package installation)
- “USERS AND GROUPS” UTILITY MIGHT BE CALLED :
  - ✓ IN TERMINAL: users-admin
  - ✓ IN ACTIVITIES: “USERS AND GROUPS”



Ubuntu 18.04.1 LTS on DESKTOP-IV1039D - Virtual Machine Connection
File
Action
Media
View
Help
Activities
Вт 18:21
Type to search...
Startup Dis...
System Mo...
Terminal
Text Editor
Thunderbir...
Time and D...
To Do
Transmission
Users and G...
Utilities
Videos
Text Editor
Frequent
All
Status: Running

“USERS AND GROUPS”



Change Advanced User Settings

Changing advanced settings for:
new-user

Contact Information | User Privileges | Advanced

Advanced Settings

☐ Disable account

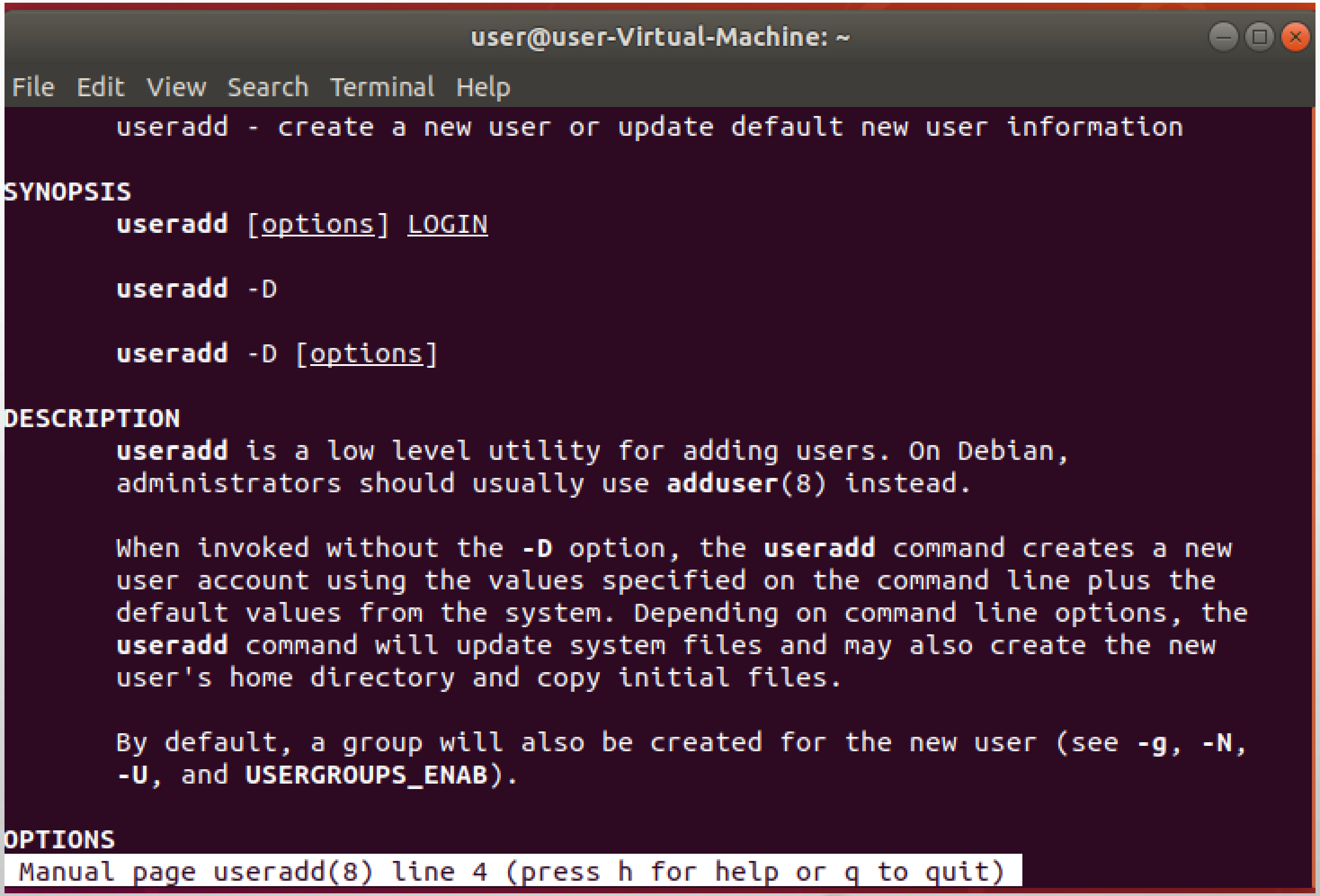
Home directory: /home/newuser

Shell: /bin/bash

Main group: newuser

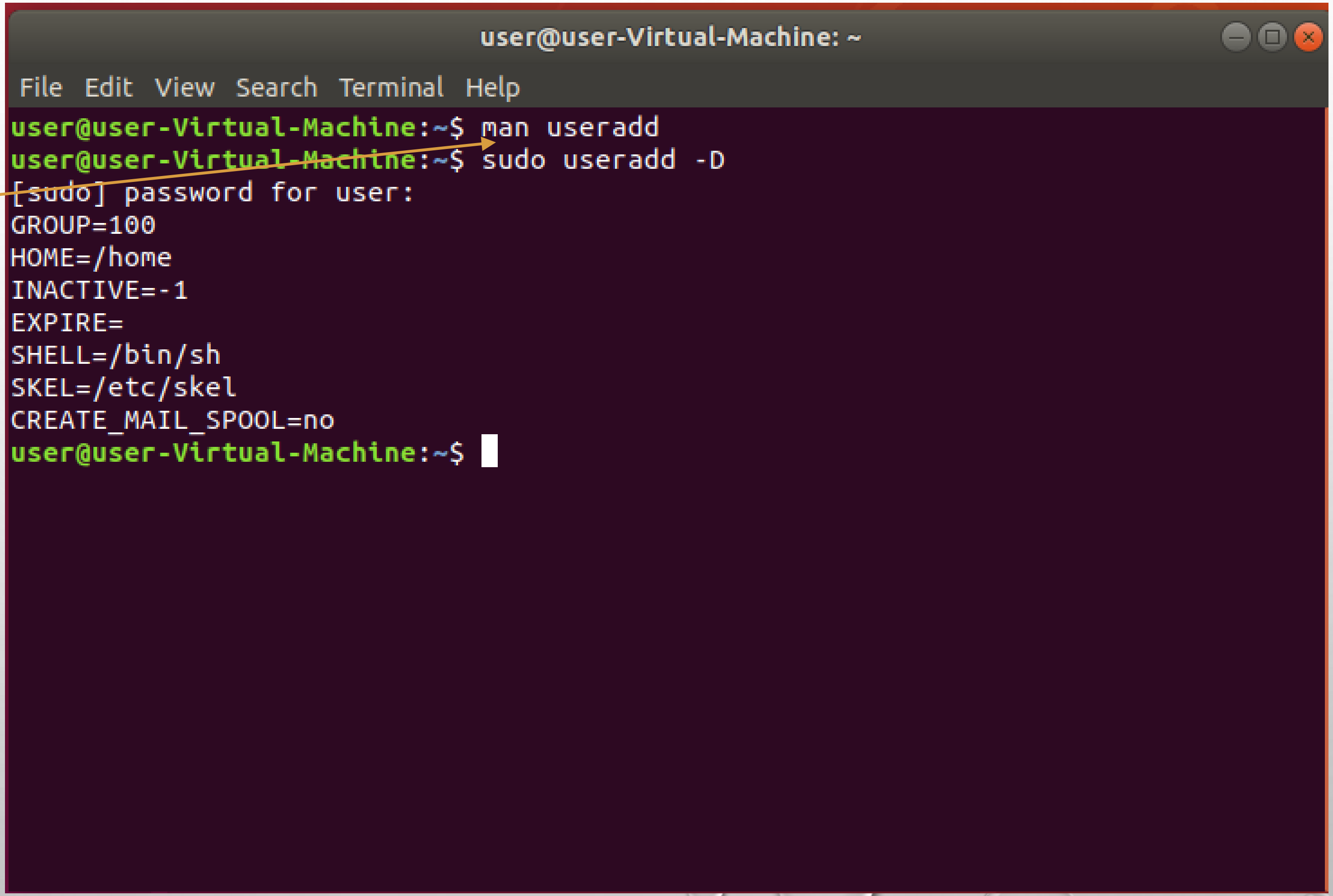
User ID: 1005

2ND OPTION: USAGE OF “USERADD”


user@user-Virtual-Machine: ~
File Edit View Search Terminal Help

```
       useradd - create a new user or update default new user information

SYNOPSIS
       useradd [options] LOGIN

       useradd -D

       useradd -D [options]

DESCRIPTION
       useradd is a low level utility for adding users. On Debian,
       administrators should usually use adduser(8) instead.

       When invoked without the -D option, the useradd command creates a new
       user account using the values specified on the command line plus the
       default values from the system. Depending on command line options, the
       useradd command will update system files and may also create the new
       user's home directory and copy initial files.

       By default, a group will also be created for the new user (see -g, -N,
       -U, and USERGROUPS_ENAB).

OPTIONS
 Manual page useradd(8) line 4 (press h for help or q to quit)
```

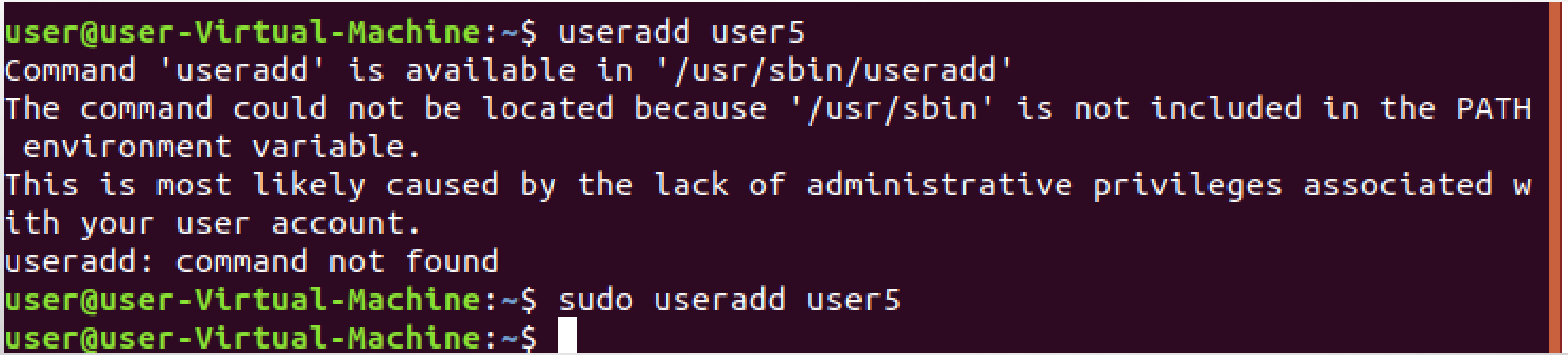
DEFAULT PARAMETERS


user@user-Virtual-Machine: ~
File Edit View Search Terminal Help

```
user@user-Virtual-Machine:~$ man useradd
user@user-Virtual-Machine:~$ sudo useradd -D
[sudo] password for user:
GROUP=100
HOME=/home
INACTIVE=-1
EXPIRE=
SHELL=/bin/sh
SKEL=/etc/skel
CREATE_MAIL_SPOOL=no
user@user-Virtual-Machine:~$
```

TO RECEIVE HELP ON COMMAND

USERADD USAGE WITH “sudo” AND WITHOUT



```
user@user-Virtual-Machine:~$ useradd user5
Command 'useradd' is available in '/usr/sbin/useradd'
The command could not be located because '/usr/sbin' is not included in the PATH
 environment variable.
This is most likely caused by the lack of administrative privileges associated w
ith your user account.
useradd: command not found
user@user-Virtual-Machine:~$ sudo useradd user5
user@user-Virtual-Machine:~$ 
```

ADDITIONAL COMMANDS FOR USER ACCOUNT MANAGEMENT

- **passwd** – TO SET USER PASSWORD (USED AFTER USERADD IF A PASSWORD HASN'T BEEN SET USING SPECIAL OPTION IN "USERADD" COMMAND) OR TO CHANGE THE EXISTING PASSWORD. TO LOG IN SUCCESSFULLY, IT IS NECESSARY TO SET THE PASSWORD FOR THE USER.
- **usermod** – TO CHANGE USER'S ACCOUNT SETTINGS
- **userdel** – TO DELETE THE USER

3RD OPTION: CONFIGURATION FILES

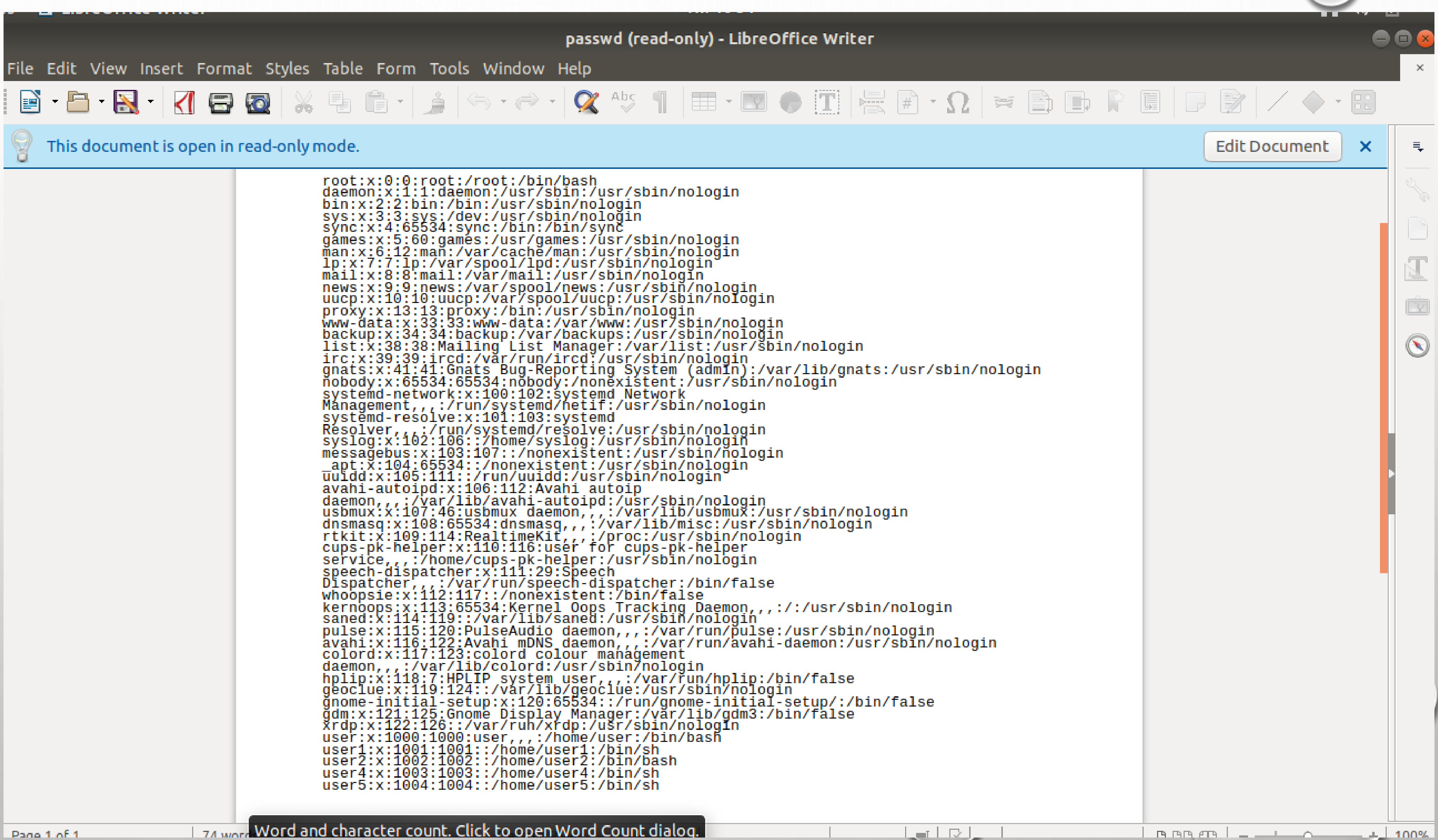
THERE ARE 3 MAIN FILES WITH USERS' DATA:

- /etc/passwd – STORES USER ACCOUNTS
- /etc/shadow – STORES ACTUAL PASSWORD IN ENCRYPTED FORMAT (MORE LIKE THE HASH OF THE PASSWORD) FOR USER'S ACCOUNT WITH ADDITIONAL PROPERTIES RELATED TO USER PASSWORD.
- /etc/groups – STORES DATA ABOUT USER GROUPS

TO CREATE USER WITH CONFIGURATION FILE EDITING:

1. EDIT FILE /etc/passwd
2. USE COMMAND “PASSWD” TO SET THE USER’S PASSWORD
3. TO ADD GRAPHICAL SETTINGS ADDITIONAL OPERATIONS ARE NECESSARY (IN SOME LINUX VERSIONS IT COULD DIFFER)
    1. CREATE HOME DIRECTORY FOR THIS USER
    2. CHANGE PERMISSIONS FOR THIS DIRECTORY
    3. COPY /ETC/SKEL CONTENT INTO THE USER HOME DIRECTORY

/etc/passwd



This document is open in read-only mode.

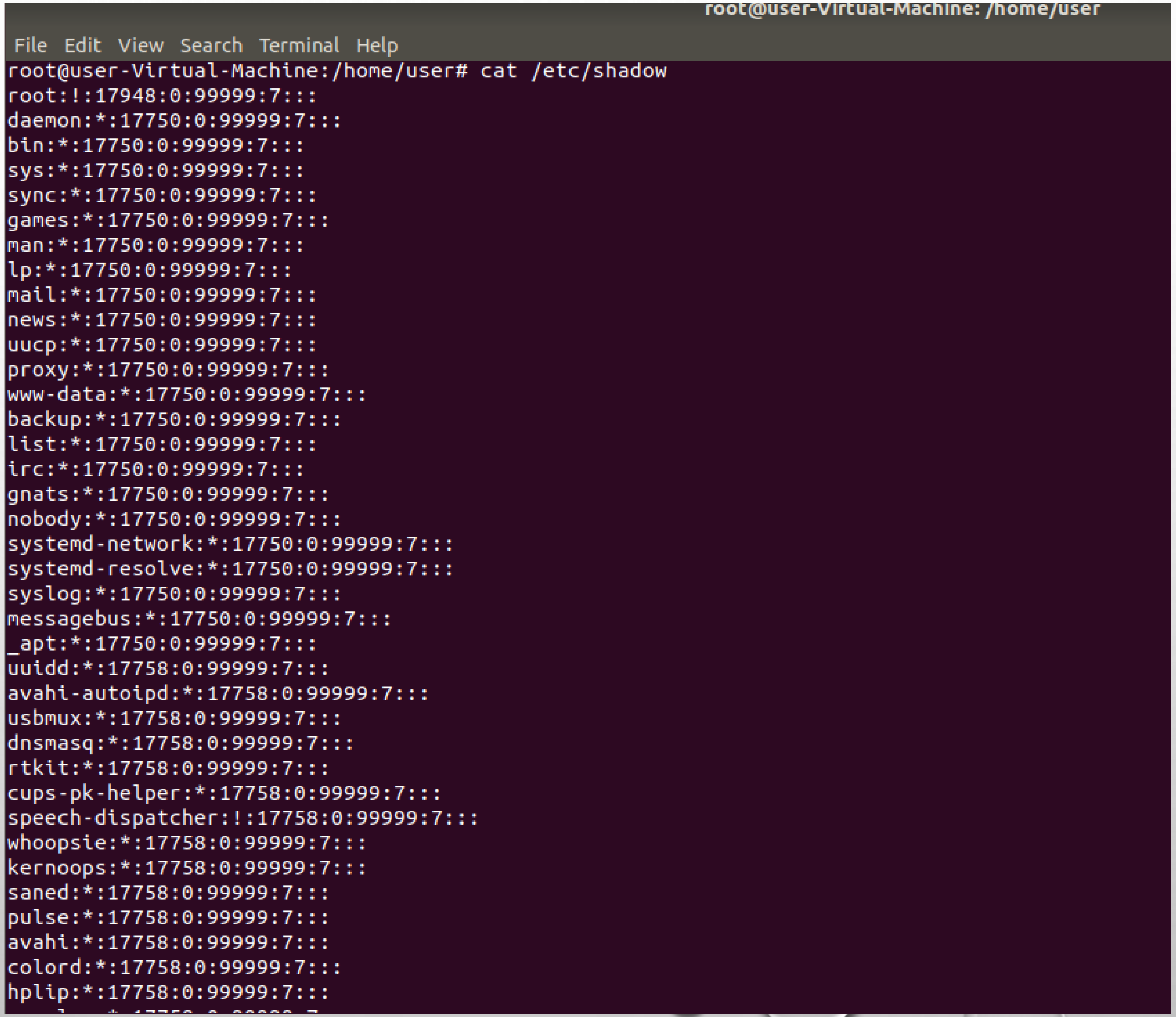
```
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-network:x:100:102:systemd Network
Management,,,:/run/systemd/netif:/usr/sbin/nologin
systemd-resolve:x:101:103:systemd
Resolver,,,:/run/systemd/resolve:/usr/sbin/nologin
syslog:x:102:106::/home/syslog:/usr/sbin/nologin
messagebus:x:103:107::/nonexistent:/usr/sbin/nologin
_apt:x:104:65534::/nonexistent:/usr/sbin/nologin
uuidd:x:105:111::/run/uuidd:/usr/sbin/nologin
avahi-autoipd:x:106:112:Avahi autoip
daemon,,,:/var/lib/avahi-autoipd:/usr/sbin/nologin
usbmux:x:107:46:usbmux daemon,,,:/var/lib/usbmux:/usr/sbin/nologin
dnsmasq:x:108:65534:dnsmasq,,,:/var/lib/misc:/usr/sbin/nologin
rtkit:x:109:114:RealtimeKit,,,:/proc:/usr/sbin/nologin
cups-pk-helper:x:110:116:user for cups-pk-helper
service,,,:/home/cups-pk-helper:/usr/sbin/nologin
speech-dispatcher:x:111:29:Speech
Dispatcher,,,:/var/run/speech-dispatcher:/bin/false
whoopsie:x:112:117::/nonexistent:/bin/false
kernoops:x:113:65534:Kernel Oops Tracking Daemon,,,:/:/usr/sbin/nologin
saned:x:114:119::/var/lib/saned:/usr/sbin/nologin
pulse:x:115:120:PulseAudio daemon,,,:/var/run/pulse:/usr/sbin/nologin
avahi:x:116:122:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/usr/sbin/nologin
colord:x:117:123:colord colour management
daemon,,,:/var/lib/colord:/usr/sbin/nologin
hplip:x:118:7:HPLIP system user,,,:/var/run/hplip:/bin/false
geoclue:x:119:124::/var/lib/geoclue:/usr/sbin/nologin
gnome-initial-setup:x:120:65534::/run/gnome-initial-setup/:/bin/false
gdm:x:121:125:Gnome Display Manager:/var/lib/gdm3:/bin/false
xrdp:x:122:126::/var/run/xrdp:/usr/sbin/nologin
user:x:1000:1000:user,,,:/home/user:/bin/bash
user1:x:1001:1001::/home/user1:/bin/sh
user2:x:1002:1002::/home/user2:/bin/bash
user4:x:1003:1003::/home/user4:/bin/sh
user5:x:1004:1004::/home/user5:/bin/sh
```

Word and character count. Click to open Word Count dialog.

/etc/passwd: FIELDS

1. **USERNAME**: IT IS USED WHEN USER LOGS IN. IT SHOULD BE BETWEEN 1 AND 32 CHARACTERS IN LENGTH.
2. **PASSWORD**: AN X CHARACTER INDICATES THAT ENCRYPTED PASSWORD IS STORED IN /etc/shadow FILE. PLEASE NOTE THAT YOU NEED TO USE THE PASSWD COMMAND TO COMPUTES THE HASH OF A PASSWORD TYPED AT THE CLI OR TO STORE/UPDATE THE HASH OF THE PASSWORD IN /etc/shadow FILE.
3. **USER ID (UID)**: EACH USER MUST BE ASSIGNED A USER ID (UID). UID 0 (ZERO) IS RESERVED FOR ROOT AND UIDS 1-99 ARE RESERVED FOR OTHER PREDEFINED ACCOUNTS. FURTHER UID 100-999 ARE RESERVED BY SYSTEM FOR ADMINISTRATIVE AND SYSTEM ACCOUNTS/GROUPS.
4. **GROUP ID (GID)**: THE PRIMARY GROUP ID (STORED IN /etc/group FILE)
5. **USER ID INFO**: THE COMMENT FIELD. IT ALLOW YOU TO ADD EXTRA INFORMATION ABOUT THE USERS SUCH AS USER’S FULL NAME, PHONE NUMBER ETC.
6. **HOME DIRECTORY**: THE ABSOLUTE PATH TO THE DIRECTORY THE USER WILL BE IN WHEN THEY LOG IN. IF THIS DIRECTORY DOES NOT EXISTS THEN USERS DIRECTORY BECOMES “/”
7. **COMMAND/SHELL**: THE ABSOLUTE PATH OF A COMMAND OR SHELL (/BIN/BASH). TYPICALLY, THIS IS A SHELL. PLEASE NOTE THAT IT DOES NOT HAVE TO BE A SHELL. THERE ARE SOME OTHER AVAILABLE SHELLS: SHELL, CSHELL, TCSHELL, AND ETC. (DEPENDS ON LINUX VERSION)

/etc/shadow


root@user-Virtual-Machine: /home/user
File Edit View Search Terminal Help

```
root@user-Virtual-Machine:/home/user# cat /etc/shadow
root:!:17948:0:99999:7:::
daemon:*:17750:0:99999:7:::
bin:*:17750:0:99999:7:::
sys:*:17750:0:99999:7:::
sync:*:17750:0:99999:7:::
games:*:17750:0:99999:7:::
man:*:17750:0:99999:7:::
lp:*:17750:0:99999:7:::
mail:*:17750:0:99999:7:::
news:*:17750:0:99999:7:::
uucp:*:17750:0:99999:7:::
proxy:*:17750:0:99999:7:::
www-data:*:17750:0:99999:7:::
backup:*:17750:0:99999:7:::
list:*:17750:0:99999:7:::
irc:*:17750:0:99999:7:::
gnats:*:17750:0:99999:7:::
nobody:*:17750:0:99999:7:::
systemd-network:*:17750:0:99999:7:::
systemd-resolve:*:17750:0:99999:7:::
syslog:*:17750:0:99999:7:::
messagebus:*:17750:0:99999:7:::
_apt:*:17750:0:99999:7:::
uuidd:*:17758:0:99999:7:::
avahi-autoipd:*:17758:0:99999:7:::
usbmux:*:17758:0:99999:7:::
dnsmasq:*:17758:0:99999:7:::
rtkit:*:17758:0:99999:7:::
cups-pk-helper:*:17758:0:99999:7:::
speech-dispatcher:!:17758:0:99999:7:::
whoopsie:*:17758:0:99999:7:::
kernoops:*:17758:0:99999:7:::
saned:*:17758:0:99999:7:::
pulse:*:17758:0:99999:7:::
avahi:*:17758:0:99999:7:::
colord:*:17758:0:99999:7:::
hplip:*:17758:0:99999:7:::
```

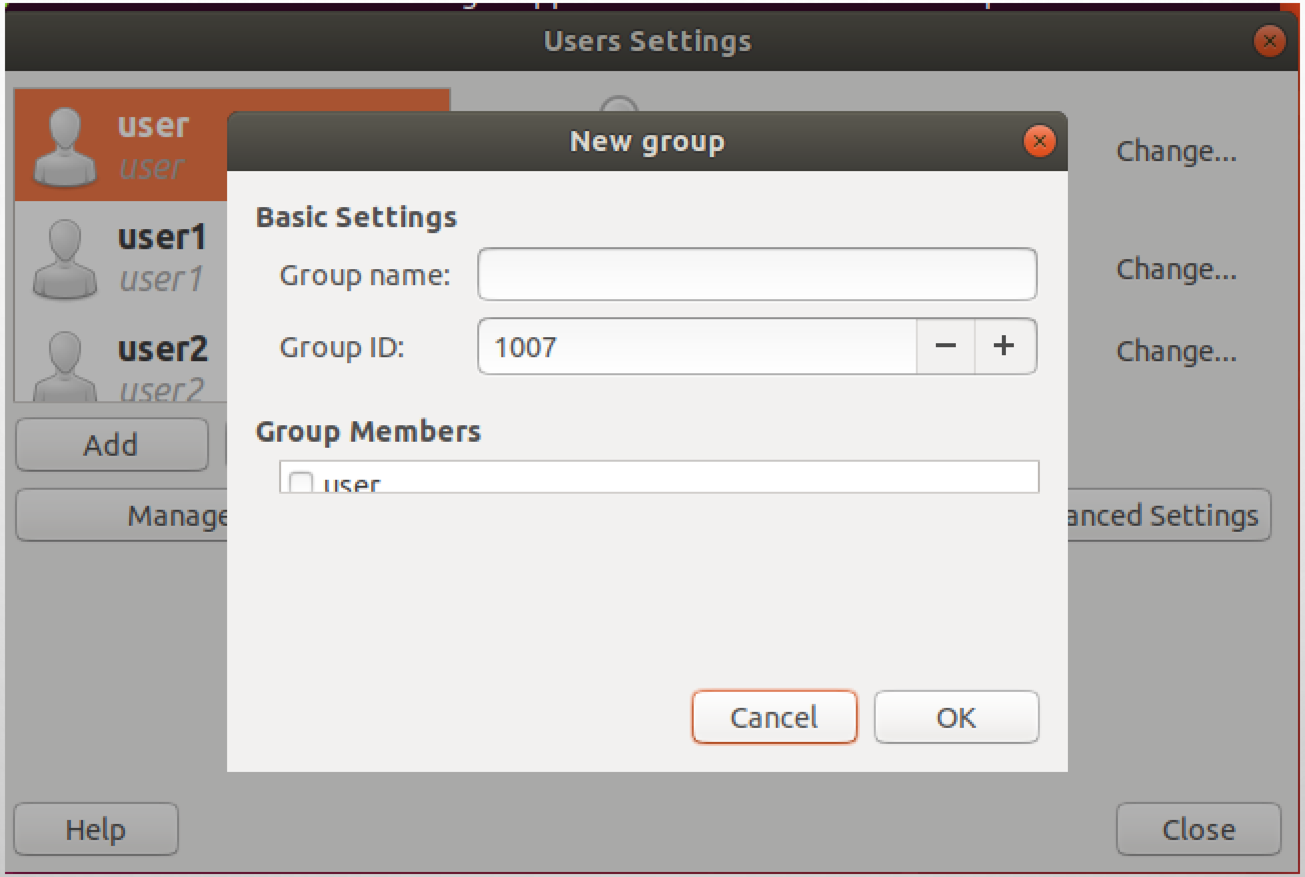
/etc/shadow: FIELDS

1. **Username** : It is your login name.
2. **Password** : It is your encrypted password. The password should be minimum 8-12 characters long including special characters, digits, lower case alphabetic and more.
3. **Last password change (last changed)** : Days since Jan 1, 1970 that password was last changed
4. **Minimum** : The minimum number of days required between password changes, i.e. the number of days left before the user is allowed to change his/her password
5. **Maximum** : The maximum number of days the password is valid (after that user is forced to change his/her password)
6. **Warn** : The number of days before password is to expire that user is warned that his/her password must be changed
7. **Inactive** : The number of days after password expires that account is disabled
8. **Expire** : days since Jan 1, 1970 that account is disabled, i.e. an absolute date specifying when the login may no longer be used.

GROUPS IN LINUX

- ➢ WITH EVERY USER CREATION A GROUP WITH THE SAME NAME IS CREATED BY DEFAULT. THIS GROUP IS CALLED "PRIMARY" GROUP FOR THIS USER.
- ➢ USERS ON LINUX SYSTEMS ARE ASSIGNED TO ONE OR MORE GROUPS FOR THE FOLLOWING REASONS:
  - ✓ TO SHARE FILES OR OTHER RESOURCE WITH A SMALL NUMBER OF USERS
  - ✓ EASE OF USER MANAGEMENT
  - ✓ EASE OF USER MONITORING
  - ✓ GROUP MEMBERSHIP IS PERFECT SOLUTION FOR LARGE LINUX INSTALLATION.
  - ✓ GROUP MEMBERSHIP GIVES YOU OR YOUR USER SPECIAL ACCESS TO FILES AND DIRECTORIES OR DEVICES WHICH ARE PERMITTED TO THAT GROUP
- ➢ GROUPS MIGHT BE CREATED:
  - ✓ WITH THE HELP OF GUI ("USERS AND GROUPS")
  - ✓ FROM THE COMMAND LINE
  - ✓ BY EDITING /etc/group FILE

“USERS AND GROUPS” IN ACTIVITIES



Basic Settings

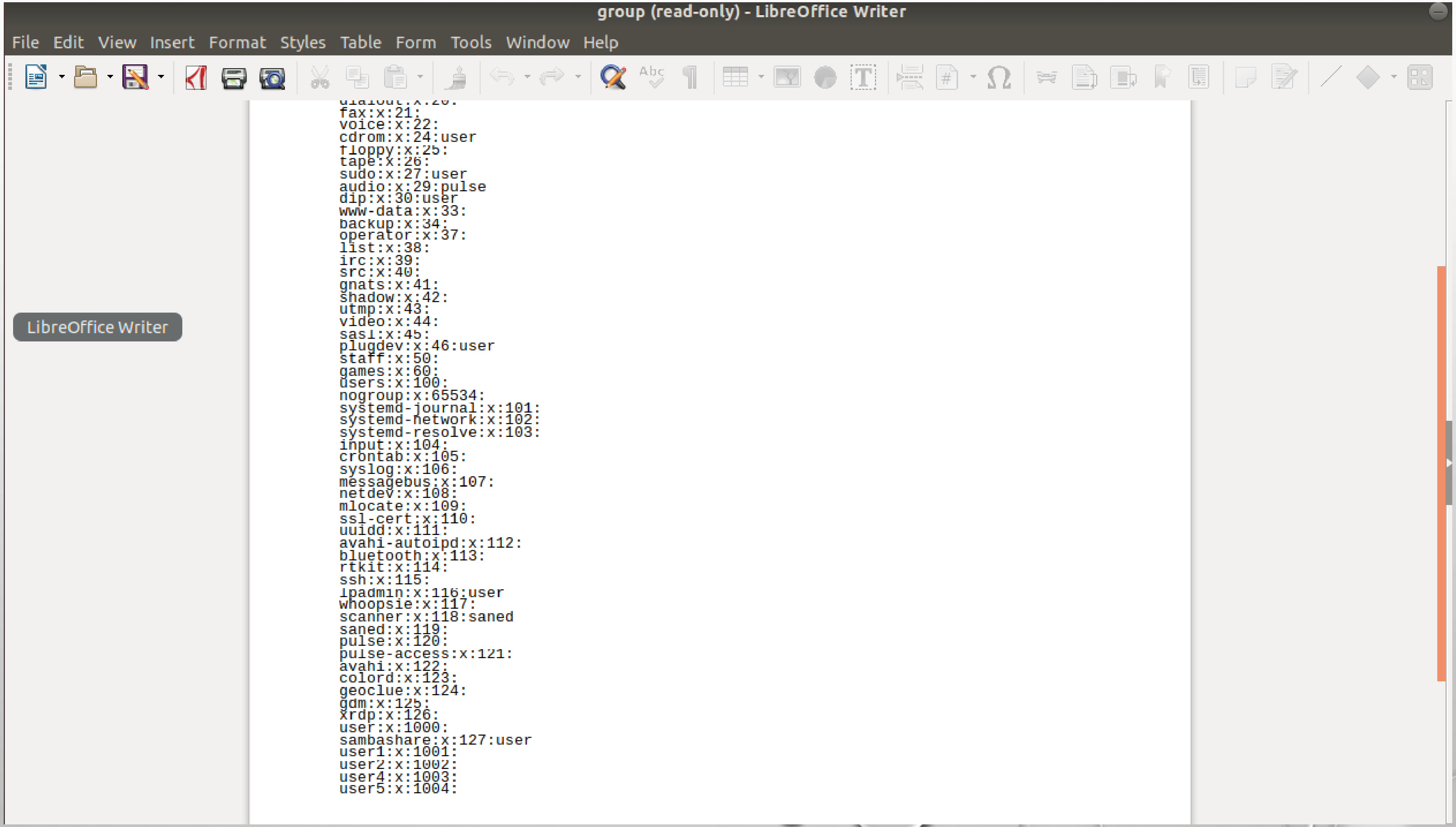
Group name:

Group ID: 1007

Group Members

□ user

/etc/group



group (read-only) - LibreOffice Writer
File Edit View Insert Format Styles Table Form Tools Window Help
LibreOffice Writer

```
dialout:x:20:
fax:x:21:
voice:x:22:
cdrom:x:24:user
floppy:x:25:
tape:x:26:
sudo:x:27:user
audio:x:29:pulse
dip:x:30:user
www-data:x:33:
backup:x:34:
operator:x:37:
list:x:38:
irc:x:39:
src:x:40:
gnats:x:41:
shadow:x:42:
utmp:x:43:
video:x:44:
sasl:x:45:
plugdev:x:46:user
staff:x:50:
games:x:60:
users:x:100:
nogroup:x:65534:
systemd-journal:x:101:
systemd-network:x:102:
systemd-resolve:x:103:
input:x:104:
crontab:x:105:
syslog:x:106:
messagebus:x:107:
netdev:x:108:
mlocate:x:109:
ssl-cert:x:110:
uuidd:x:111:
avahi-autoipd:x:112:
bluetooth:x:113:
rtkit:x:114:
ssh:x:115:
lpadmin:x:116:user
whoopsie:x:117:
scanner:x:118:saned
saned:x:119:
pulse:x:120:
pulse-access:x:121:
avahi:x:122:
colord:x:123:
geoclue:x:124:
gdm:x:125:
xrdp:x:126:
user:x:1000:
sambashare:x:127:user
user1:x:1001:
user2:x:1002:
user4:x:1003:
user5:x:1004:
```

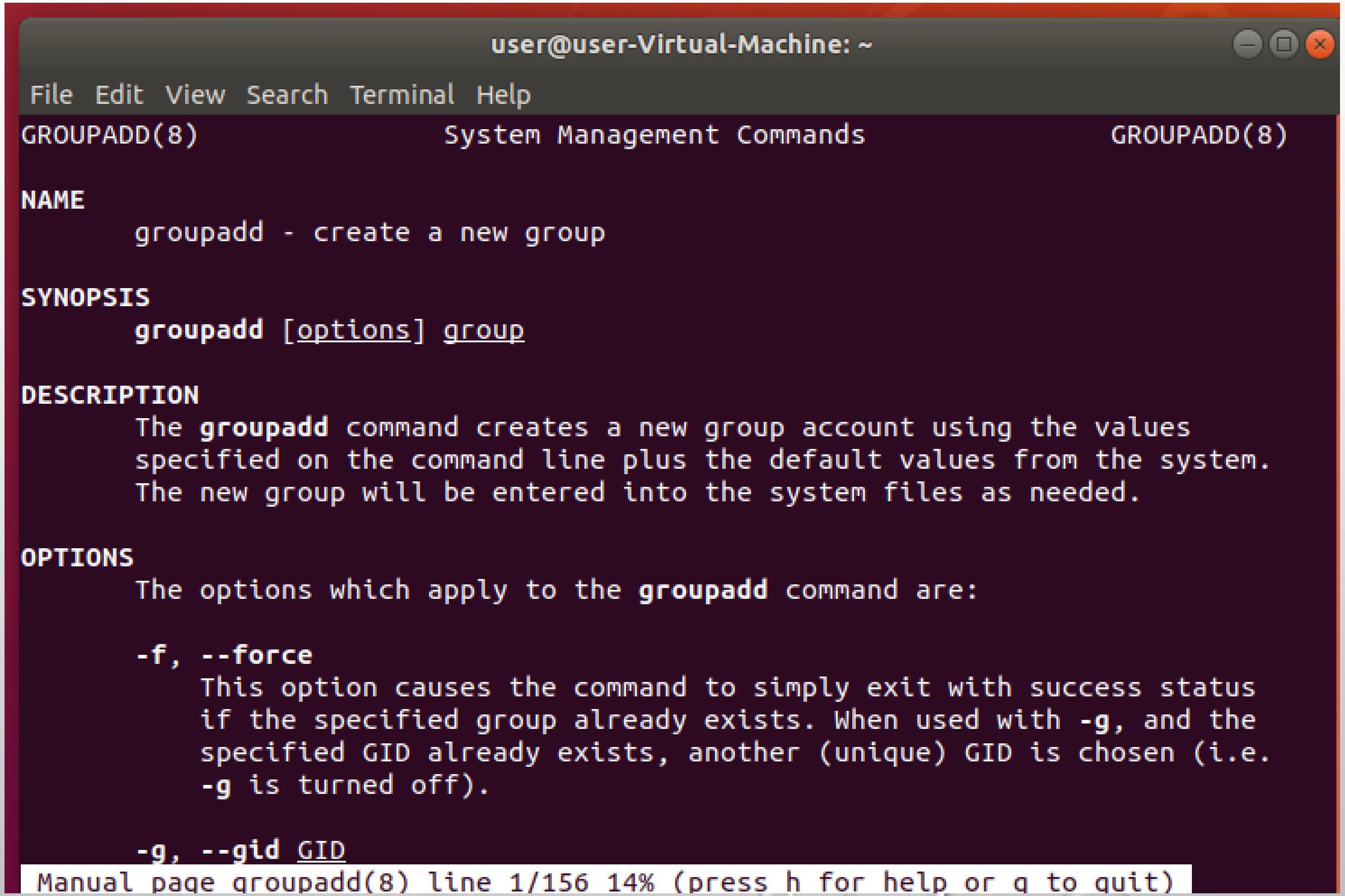
/etc/group: FIELDS

1. **GROUP_NAME**: IT IS THE NAME OF GROUP. IF YOU RUN LS -L COMMAND, YOU WILL SEE THIS NAME PRINTED IN THE GROUP FIELD.
2. **PASSWORD**: GENERALLY PASSWORD IS NOT USED, HENCE IT IS EMPTY/BLANK. IT CAN STORE ENCRYPTED PASSWORD. THIS IS USEFUL TO IMPLEMENT PRIVILEGED GROUPS.
3. **GROUP ID (GID)**: EACH USER MUST BE ASSIGNED A GROUP ID. YOU CAN SEE THIS NUMBER IN YOUR /ETC/PASSWD FILE.
4. **GROUP LIST**: IT IS A LIST OF USER NAMES OF USERS WHO ARE MEMBERS OF THE GROUP. THE USER NAMES, MUST BE SEPARATED BY COMMAS (THE USER FOR WHOM THIS GROUP IS CONSIDERED TO BE PRIMARY IS NOT SHOWN IN THE GROUP LIST)

GROUP MANAGEMENT FROM COMMAND LINE (TERMINAL WINDOW)

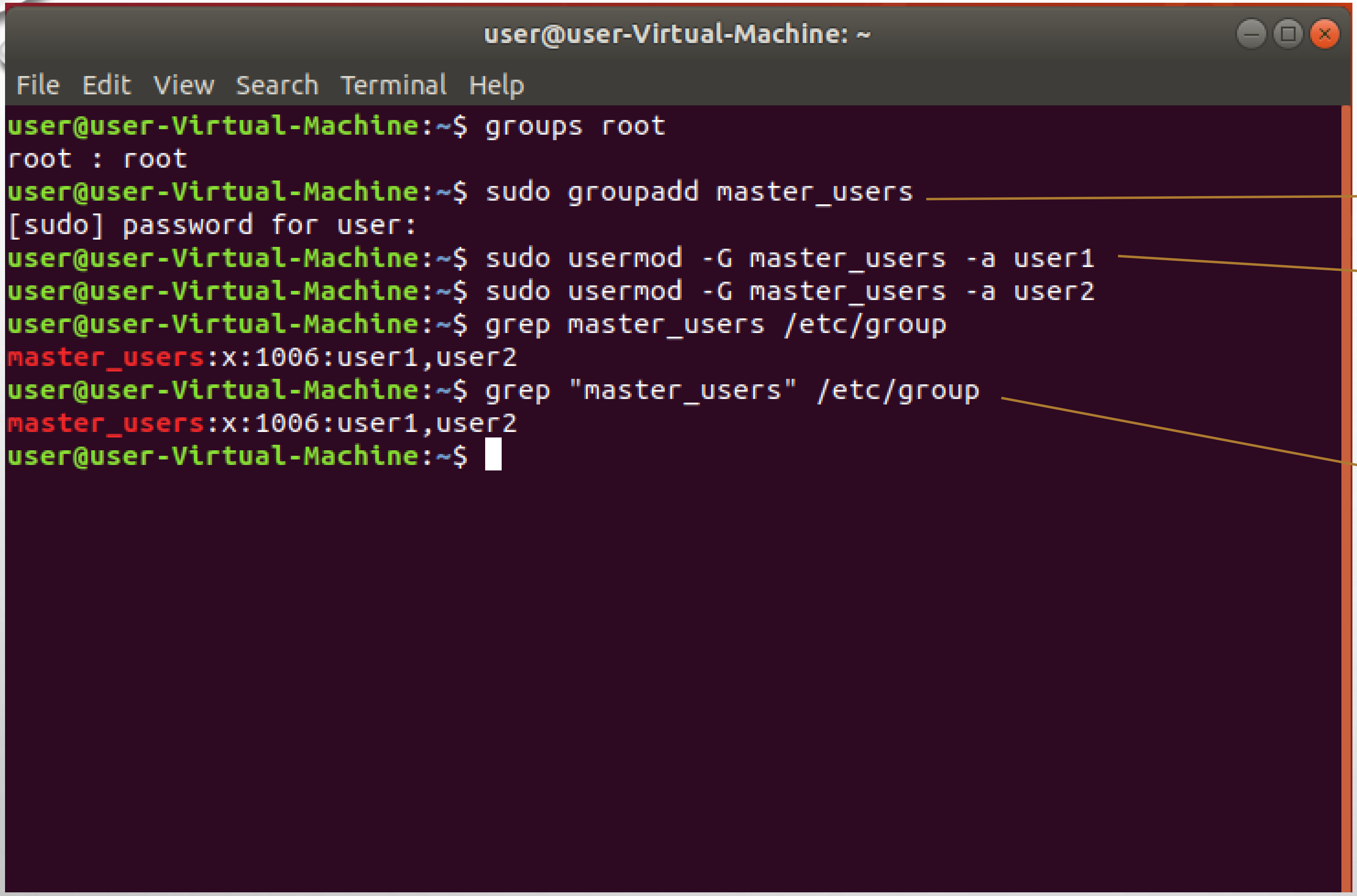
- ➢ /etc/group EDITING
- ➢ COMMANDS:
  - ✓ groupadd – TO CREATE A GROUP
  - ✓ groupmod – TO MODIFY A GROUP
  - ✓ groups – TO SHOW GROUPS FOR A SPECIFIED USER

MAN FOR “groupadd”



user@user-Virtual-Machine: ~
File Edit View Search Terminal Help

```
GROUPADD(8)                 System Management Commands                GROUPADD(8)

NAME
       groupadd - create a new group

SYNOPSIS
       groupadd [options] group

DESCRIPTION
       The groupadd command creates a new group account using the values
       specified on the command line plus the default values from the system.
       The new group will be entered into the system files as needed.

OPTIONS
       The options which apply to the groupadd command are:

       -f, --force
           This option causes the command to simply exit with success status
           if the specified group already exists. When used with -g, and the
           specified GID already exists, another (unique) GID is chosen (i.e.
           -g is turned off).

       -g, --gid GID
 Manual page groupadd(8) line 1/156 14% (press h for help or q to quit)
```


user@user-Virtual-Machine: ~
File Edit View Search Terminal Help

```
user@user-Virtual-Machine:~$ groups root
root : root
user@user-Virtual-Machine:~$ sudo groupadd master_users
[sudo] password for user:
user@user-Virtual-Machine:~$ sudo usermod -G master_users -a user1
user@user-Virtual-Machine:~$ sudo usermod -G master_users -a user2
user@user-Virtual-Machine:~$ grep master_users /etc/group
master_users:x:1006:user1,user2
user@user-Virtual-Machine:~$ grep "master_users" /etc/group
master_users:x:1006:user1,user2
user@user-Virtual-Machine:~$
```

Create group “master-users”

Include user “user1” into the group “master-users”

Find line “master_users” in the file /etc/groups

HOME TASK

1. CREATE 3 DIFFERENT USERS IN YOUR SYSTEM (USE BOTH GUI, AND TERMINAL FUNCTIONALITY)
2. INCLUDE THEY IN GROUP WITH THE NAME “RIM-181229”
3. PROVE THEIR EXISTENCE BY REVEALING THEIR DATA IN ALL CONFIGURATION FILES
4. WHAT DATA IS STORED ABOUT EVERY USER IN THE FILE WITH USERS’ ACCOUNTS? (EXPLAIN YOUR ANSWER ON THE BASIS OF A PARTICULAR ACCOUNT)