TASK 5.3

Part 1:

1. How many states could have a process in Linux?

Process state: created, ready, terminated, running, waiting, admitted, interrupt

2. Examine the pstree command. Make output (highlight) the chain (ancestors) of the current process.

```
 * Documentation:  https://help.ubuntu.com/
root@CsnKhai:~# echo $$
884
root@CsnKhai:~# pstree -s 884
init---login---bash---pstree
root@CsnKhai:~#
```

3. What is a proc file system?

-- is a virtual file system that provides an interface to kernel data structures and information about processes and system resources. It is not a traditional file system that stores data on disk but rather a way for the kernel to expose various system and process-related information to userspace applications and users.

4. Print information about the processor (its type, supported technologies, etc.).

```
root@CsnKhai:~# lscpu
Architecture:          i686
CPU op-mode(s):        32-bit
Byte Order:            Little Endian
CPU(s):                1
On-line CPU(s) list:   0
Thread(s) per core:    1
Core(s) per socket:    1
Socket(s):             1
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 140
Stepping:              1
CPU MHz:               2419.332
BogoMIPS:              4838.66
L1d cache:             48K
L1i cache:             32K
L2 cache:              1280K
L3 cache:              8192K
root@CsnKhai:~#
```

5. Use the ps command to get information about the process. The information should be as follows: the owner of the process, the arguments with which the process was launched for execution, the group owner of this process, etc.

```
root      [kworker/u3:1]              root
root      [jbd2/sda1-8]               root
root      [ext4-rsv-conver]           root
root      upstart-udev-bridge --daemo root
root      /lib/systemd/systemd-udevd  root
message+ dbus-daemon --system --fork messagebus
root      /lib/systemd/systemd-logind root
syslog    rsyslogd                    syslog
root      upstart-file-bridge --daemo root
root      upstart-socket-bridge --dae root
root      dhclient -1 -v -pf /run/dhc root
root      /sbin/getty -8 38400 tty4   root
root      /sbin/getty -8 38400 tty5   root
root      /sbin/getty -8 38400 tty2   root
root      /sbin/getty -8 38400 tty3   root
root      /sbin/getty -8 38400 tty6   root
root      /usr/sbin/sshd -D           root
root      cron                        root
root      /bin/login --               root
root      [kauditd]                   root
root      -bash                       root
root      [kworker/u2:1]              root
root      [kworker/0:0]               root
root      [kworker/u2:0]              root
root      ps -eo user,args,group      root
```

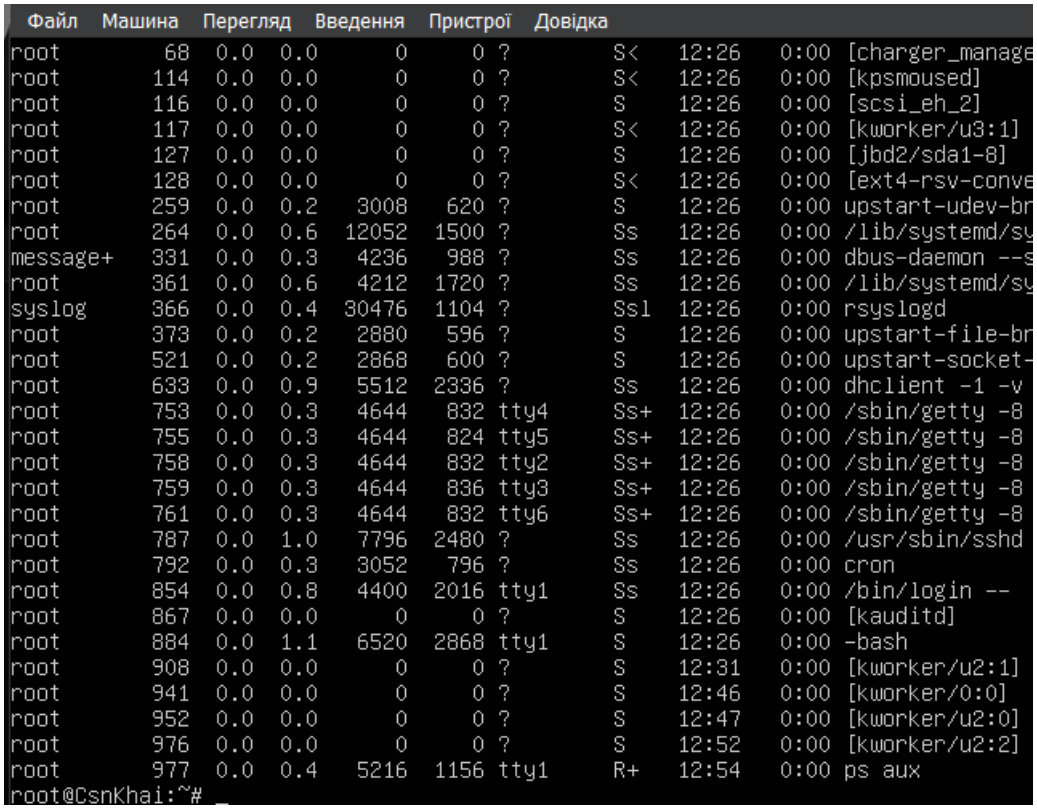
6. How to define kernel processes and user processes?

```
root@CsnKhai:~# ps ef
  PID TTY      STAT   TIME COMMAND
  854 tty1     Ss     0:00 /bin/login --      PATH=/usr/local/sbin:/usr/local/bi
  884 tty1     S      0:00  \_ -bash TERM=linux HOME=/root SHELL=/bin/bash USER=
  940 tty1     R+     0:00      \_ ps ef XDG_VTNR=1 XDG_SESSION_ID=c1 SHELL=/bin
  761 tty6     Ss+    0:00 /sbin/getty -8 38400 tty6 PATH=/usr/local/sbin:/usr/l
  759 tty3     Ss+    0:00 /sbin/getty -8 38400 tty3 PATH=/usr/local/sbin:/usr/l
  758 tty2     Ss+    0:00 /sbin/getty -8 38400 tty2 PATH=/usr/local/sbin:/usr/l
  755 tty5     Ss+    0:00 /sbin/getty -8 38400 tty5 PATH=/usr/local/sbin:/usr/l
  753 tty4     Ss+    0:00 /sbin/getty -8 38400 tty4 PATH=/usr/local/sbin:/usr/l
root@CsnKhai:~# _
```

```
root@CsnKhai:~# ps aux | grep dd
root         2  0.0  0.0      0     0 ?        S    12:26   0:00 [kthreadd]
root       954  0.0  0.3   4676   820 tty1     S+   12:47   0:00 grep --color=au
to dd
root@CsnKhai:~#
```

7. Print the list of processes to the terminal. Briefly describe the statuses of the processes.

What condition are they in, or can they be arriving in?



S< (High-Priority Scheduling Class): This status indicates a process that is in the "idle" state and is using the "high-priority scheduling class." It's a special state that some processes might enter when they are waiting for CPU time and have been placed in the high-priority queue.

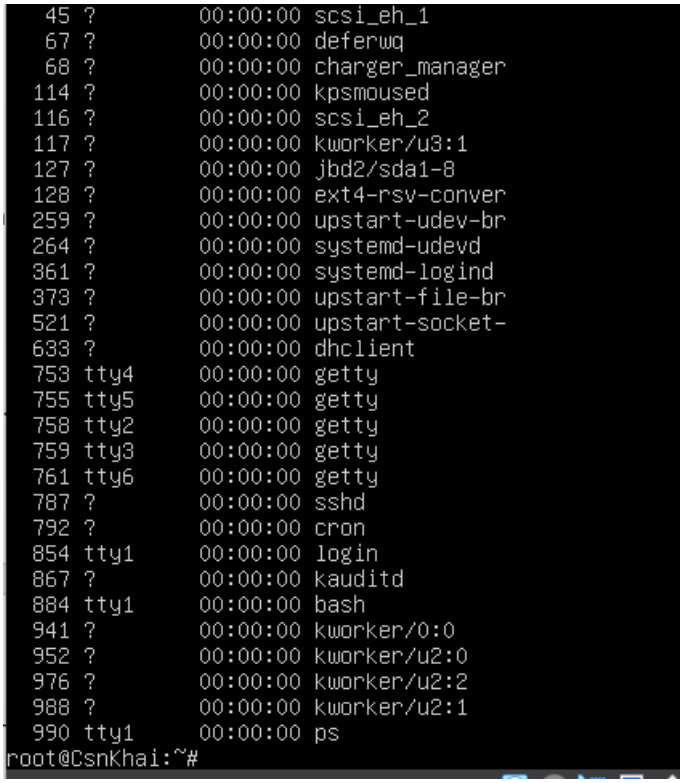
R+ (Running or Runnable): The "+" sign after "R" indicates that the process is in the foreground process group. This status means the process is currently running or ready to run on a CPU core.

Ssl (Interruptible Sleep - Scheduling): This status indicates a process that is in an interruptible sleep state. The "l" means that the process is multi-threaded and is using a lock. The process is waiting for a condition to be met and can be awakened by signals or other events.

Ss (Session Leader - Interruptible Sleep): This status indicates a session leader process that is in an interruptible sleep state. Session leaders are typically the first process in a session, and they manage terminal sessions. Like "Ssl," this process can be awakened by signals or other events.

8. Display only the processes of a specific user.

ps -u root command



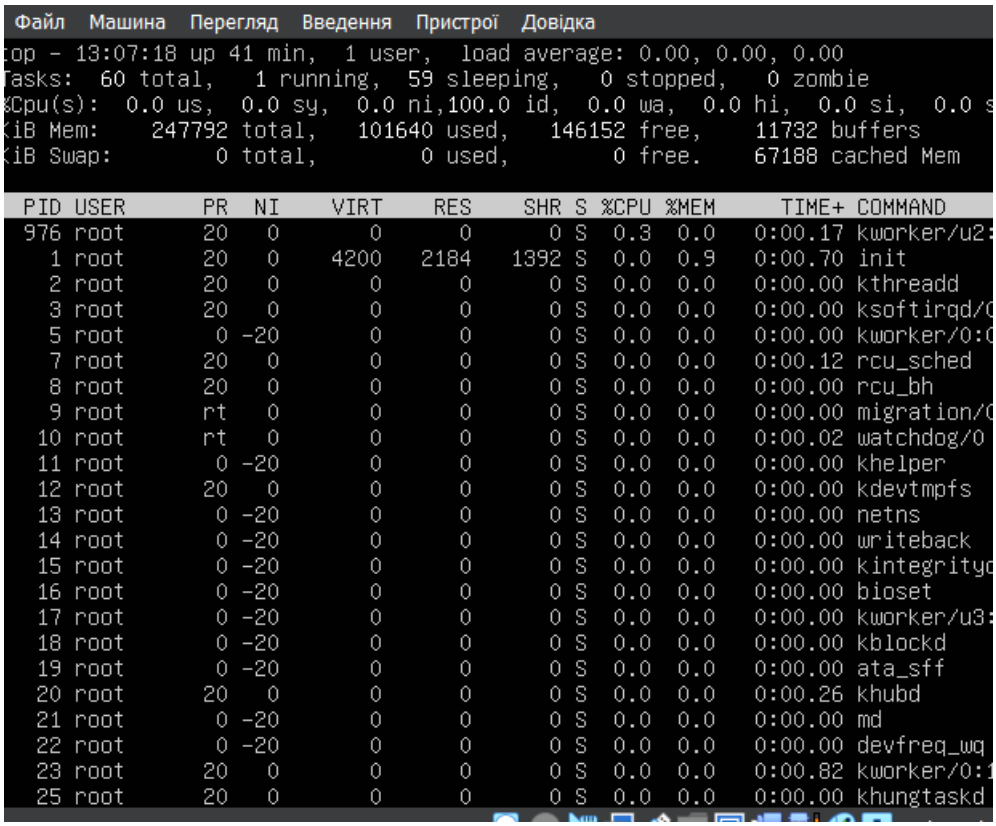
9. What utilities can be used to analyze existing running tasks (by analyzing the help for the ps command)?

ps aux: This command provides a detailed list of all running processes along with various information, including process IDs, statuses, resource usage, and more.

ps -ef: Similar to ps aux, this command displays a detailed list of all processes in a different format.

ps -e: This command displays a list of all processes, showing only their process IDs and statuses. It's a more compact view compared to ps aux.

10. What information does top command display?



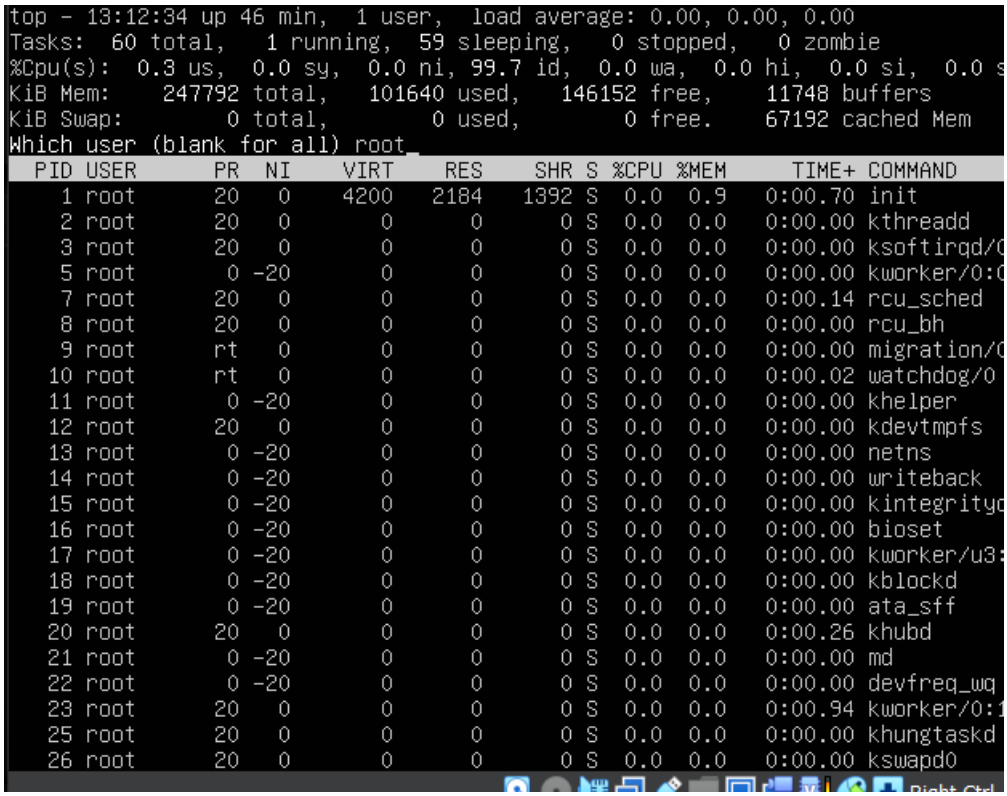
A convenient tool to manage processes is top.

For common process management tasks, top is so great because it gives an overview of the most active processes currently running (hence the name top). This enables you to easily find processes that might need attention. From top, you can also perform common process management tasks, such as adjusting the current process priority and killing processes.

Among the information that you can conveniently obtain from the top utility is the process state.

Here is the information that the «top» command typically displays: Overall System Information, Global Resource Usage, Process List, Interactive Features.

12. Display the processes of the specific user using the top command.



12. What interactive commands can be used to control the top command? Give a couple of examples.

q: Quit top.

Example: Press q to exit top.

u: Enter "User filter" mode to display processes for a specific user.

Example: Press u, enter the username, and press Enter to filter processes for that user.

k: Kill a process. You'll be prompted to enter the PID of the process you want to kill.

Example: Press k, enter the PID of the process, and press Enter.

r: Renice a process to change its priority.

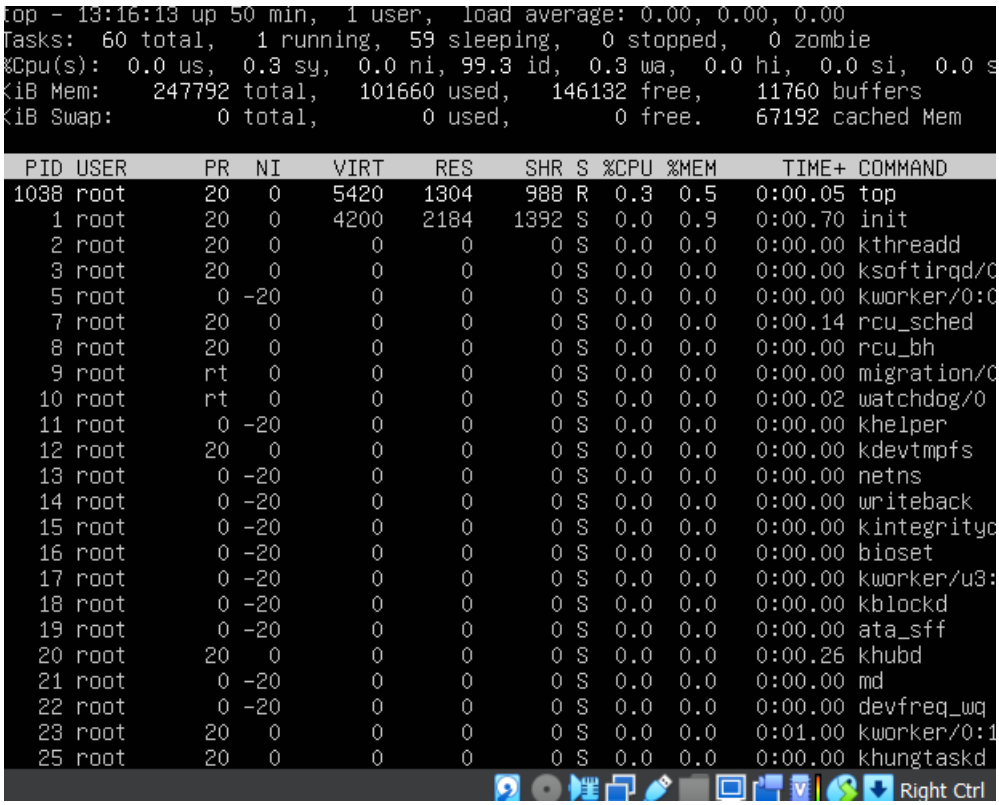
Example: Press r, enter the PID of the process, enter the new nice value, and press Enter.

i: Toggle idle-only tasks display. When enabled, only tasks that are currently using CPU time are displayed.

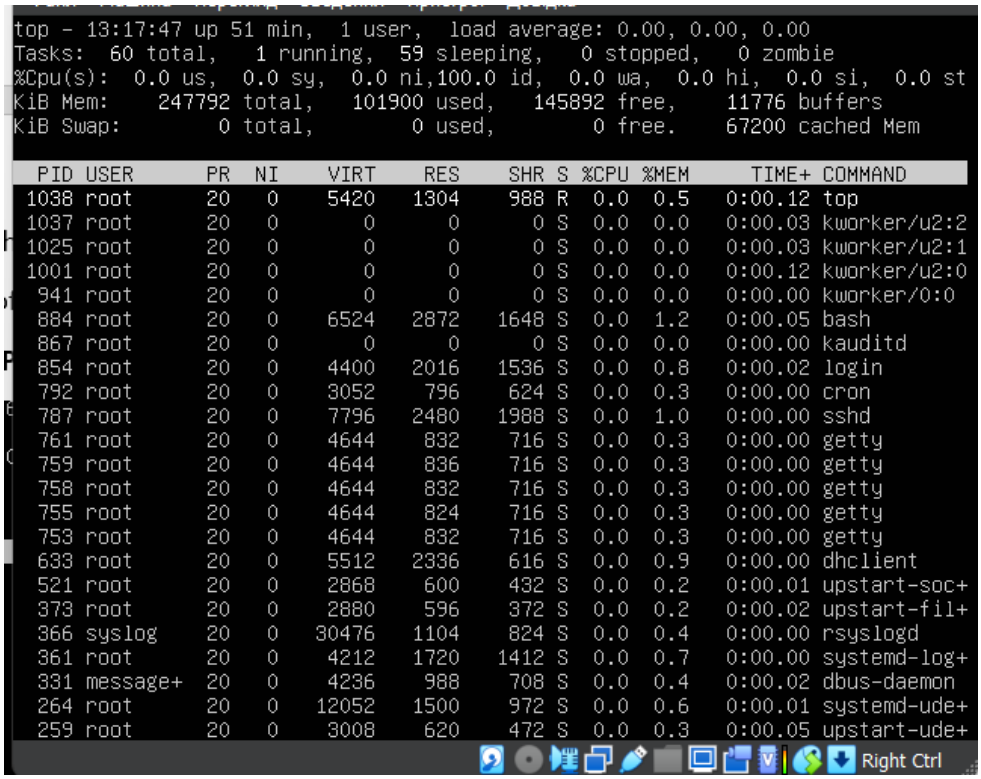
Example: Press i to toggle idle-only tasks display.

13. Sort the contents of the processes window using various parameters (for example, the amount of processor time taken up, etc.)

Sort by CPU Usage:



Sort by Process ID:



14. Concept of priority, what commands are used to set priority?

«nice» command, **«renice»** command

15. Can I change the priority of a process using the top command? If so, how?

We need to use press the **«r»** key. Enter the PID process whose priority we want to change and press Enter. Then we need to enter the new priority value.

16. Examine the kill command. How to send with the kill command

process control signal? Give an example of commonly used signals.

Sometimes the kill command does not work because the process you want to kill is busy. In that

case, you can use kill -9 to send the SIGKILL signal to the process. Because the SIGKILL signal cannot

be ignored, it forces the process to stop, but you also risk losing data while using this command.

SIGTERM (15): This is the default signal sent by the kill command. It requests that the process terminate gracefully, allowing it to clean up resources before exiting.

17. Commands jobs, fg, bg, nohup. What are they for? Use the sleep, yes command to

demonstrate the process control mechanism with fg, bg.

They allow you to manage the execution of processes in the foreground, background, and even after you log out of a terminal session.

jobs: This command is used to list the current jobs that are running or suspended in the background. Each job is assigned a job number.

fg: The fg command is used to bring a job to the foreground, allowing it to receive input and display output on the terminal. You can specify the job number to bring a specific job to the foreground.

bg: The bg command is used to resume a suspended job in the background. This allows a job to continue running even if you switch to another task or log out.

nohup: The nohup command is used to run a command immune to hangups (i.e., it will keep running even if the terminal session is disconnected or closed). It's often used in combination with the & symbol to run a command in the background.

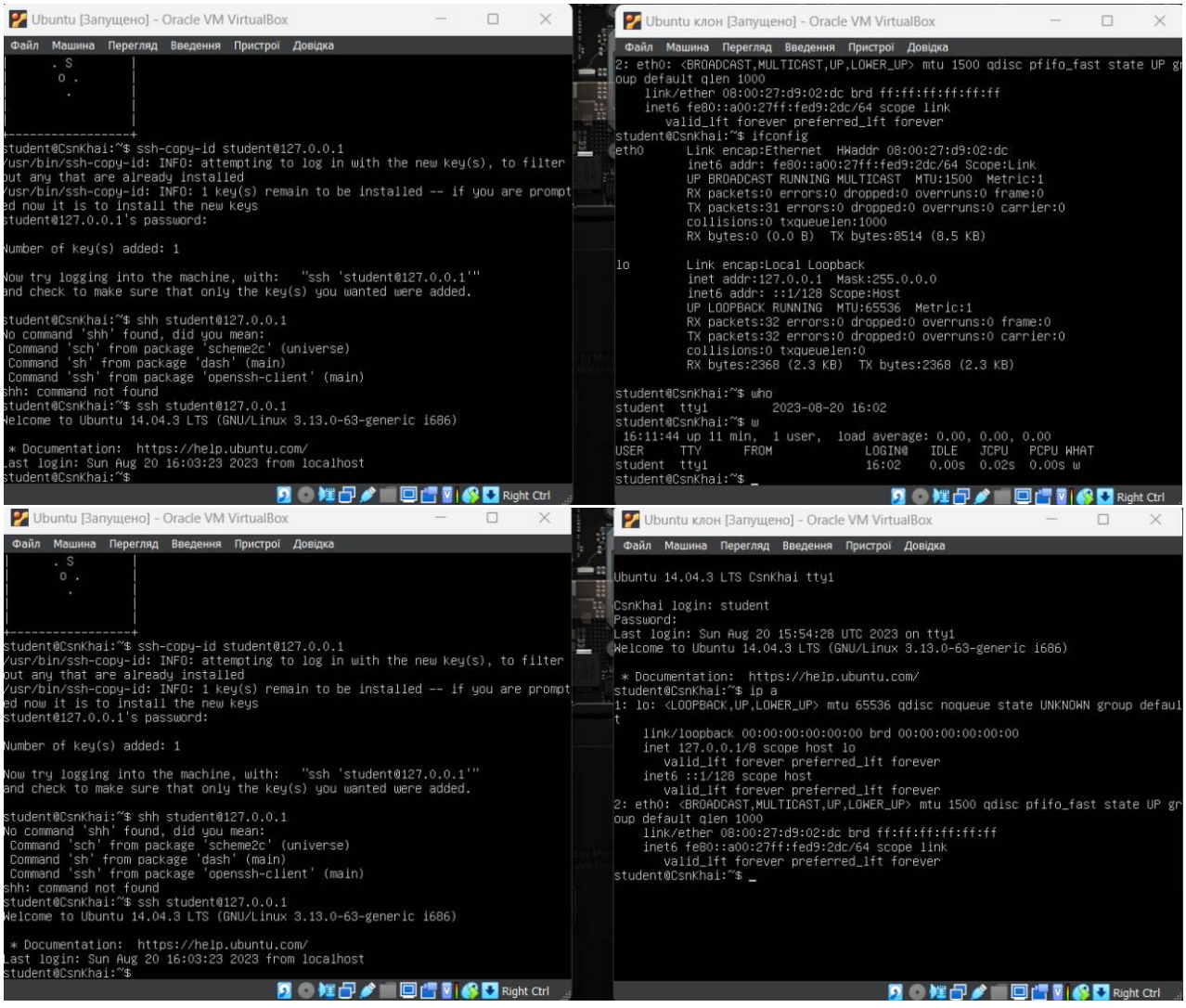
```
root@CsnKhai:~# sleep 10
^Z
[1]+  Stopped                 sleep 10
root@CsnKhai:~# bg
[1]+ sleep 10 &
root@CsnKhai:~# fg
-bash: fg: job has terminated
[1]+  Done                    sleep 10
root@CsnKhai:~#
```

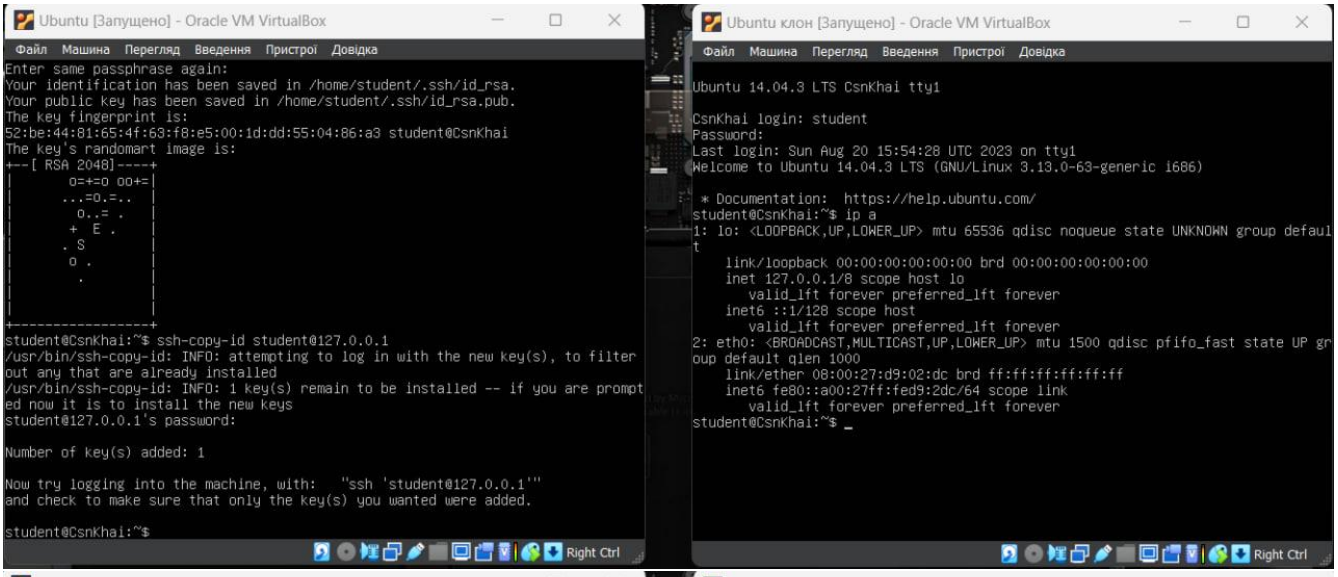
Part 2:

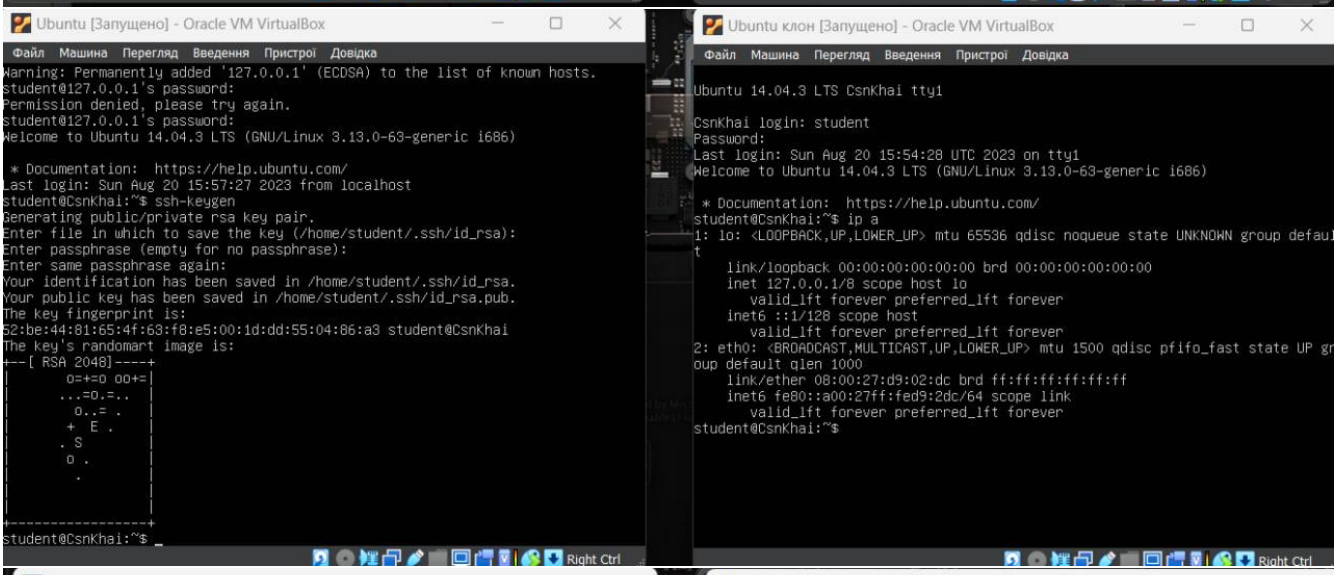
1. Check the implementability of the most frequently used OPENSSH commands in the MS Windows operating system. (Description of the expected result of the commands + screenshots: command – result should be presented)

Implement basic SSH settings to increase the security of the client-server connection

Implement port forwarding for the SSH client from the host machine to the guest Linux virtual machine behind NAT.




Ubuntu [Запущено] - Oracle VM VirtualBox
Файл Машина Перегляд Введення Пристрої Довідка
Enter same passphrase again:
Your identification has been saved in /home/student/.ssh/id_rsa.
Your public key has been saved in /home/student/.ssh/id_rsa.pub.
The key fingerprint is:
52:be:44:81:65:4f:63:f8:e5:00:1d:dd:55:04:86:a3 student@CsnKhai
The key's randomart image is:
+--[RSA 2048]----+
student@CsnKhai:~$ ssh-copy-id student@127.0.0.1
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
student@127.0.0.1's password:
Number of key(s) added: 1
Now try logging into the machine, with: "ssh 'student@127.0.0.1'" and check to make sure that only the key(s) you wanted were added.
student@CsnKhai:~$
Right Ctrl
Ubuntu клон [Запущено] - Oracle VM VirtualBox
Файл Машина Перегляд Введення Пристрої Довідка
Ubuntu 14.04.3 LTS CsnKhai tty1
CsnKhai login: student
Password:
Last login: Sun Aug 20 15:54:28 UTC 2023 on tty1
Welcome to Ubuntu 14.04.3 LTS (GNU/Linux 3.13.0-63-generic i686)
* Documentation: https://help.ubuntu.com/
student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 08:00:27:d9:02:dc brd ff:ff:ff:ff:ff:ff
inet6 fe80::a00:27ff:fed9:2dc/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$
Right Ctrl


Ubuntu [Запущено] - Oracle VM VirtualBox
Файл Машина Перегляд Введення Пристрої Довідка
Warning: Permanently added '127.0.0.1' (ECDSA) to the list of known hosts.
student@127.0.0.1's password:
Permission denied, please try again.
student@127.0.0.1's password:
Welcome to Ubuntu 14.04.3 LTS (GNU/Linux 3.13.0-63-generic i686)
* Documentation: https://help.ubuntu.com/
Last login: Sun Aug 20 15:57:27 2023 from localhost
student@CsnKhai:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/student/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/student/.ssh/id_rsa.
Your public key has been saved in /home/student/.ssh/id_rsa.pub.
The key fingerprint is:
52:be:44:81:65:4f:63:f8:e5:00:1d:dd:55:04:86:a3 student@CsnKhai
The key's randomart image is:
+--[RSA 2048]----+
student@CsnKhai:~$
Right Ctrl
Ubuntu клон [Запущено] - Oracle VM VirtualBox
Файл Машина Перегляд Введення Пристрої Довідка
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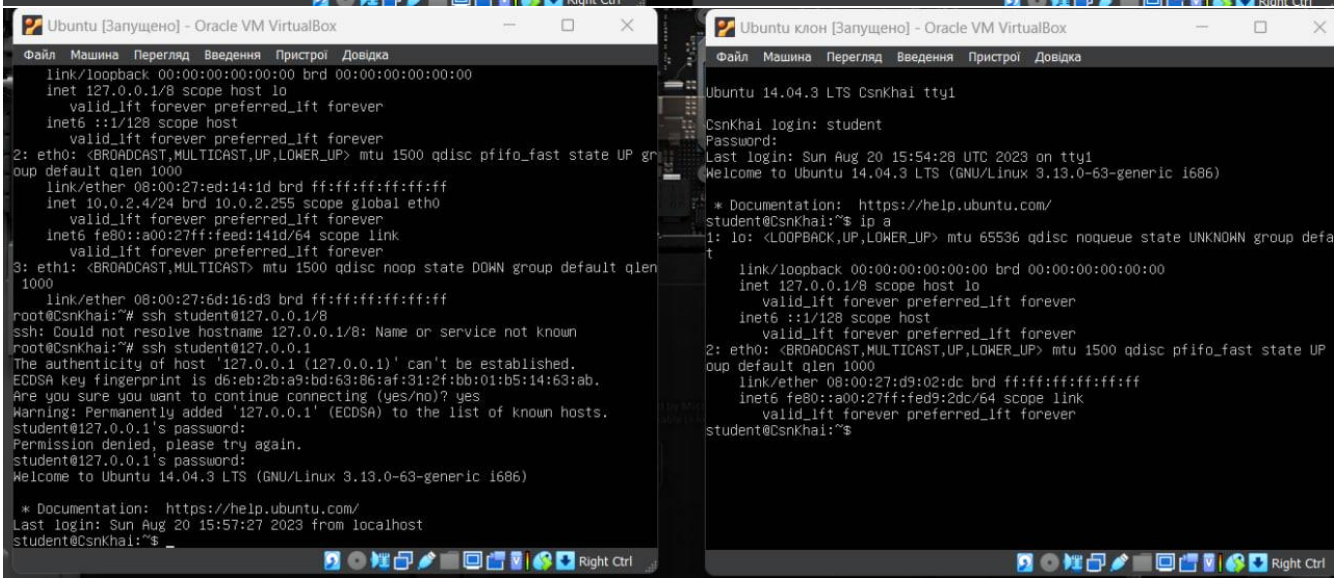
student@CsnKhai:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 08:00:27:d9:02:dc brd ff:ff:ff:ff:ff:ff
inet6 fe80::a00:27ff:fed9:2dc/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$
Right Ctrl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link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 08:00:27:ed:14:1d brd ff:ff:ff:ff:ff:ff
inet 10.0.2.4/24 brd 10.0.2.255 scope global eth0
valid_lft forever preferred_lft forever
inet6 fe80::a00:27ff:feed:141d/64 scope link
valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
link/ether 08:00:27:6d:16:d3 brd ff:ff:ff:ff:ff:ff
root@CsnKhai:~# ssh student@127.0.0.1/8
ssh: Could not resolve hostname 127.0.0.1/8: Name or service not known
root@CsnKhai:~# ssh student@127.0.0.1
The authenticity of host '127.0.0.1 (127.0.0.1)' can't be established.
ECDSA key fingerprint is d6:eb:2b:a9:bd:63:86:af:31:2f:bb:01:b5:14:63:ab.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '127.0.0.1' (ECDSA) to the list of known hosts.
student@127.0.0.1's password:
Permission denied, please try again.
student@127.0.0.1's password:
Welcome to Ubuntu 14.04.3 LTS (GNU/Linux 3.13.0-63-generic i686)
* Documentation: https://help.ubuntu.com/
Last login: Sun Aug 20 15:57:27 2023 from localhost
student@CsnKhai:~$
Right Ctrl
Ubuntu клон [Запущено] - Oracle VM VirtualBox
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Ubuntu 14.04.3 LTS CsnKhai tty1
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link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
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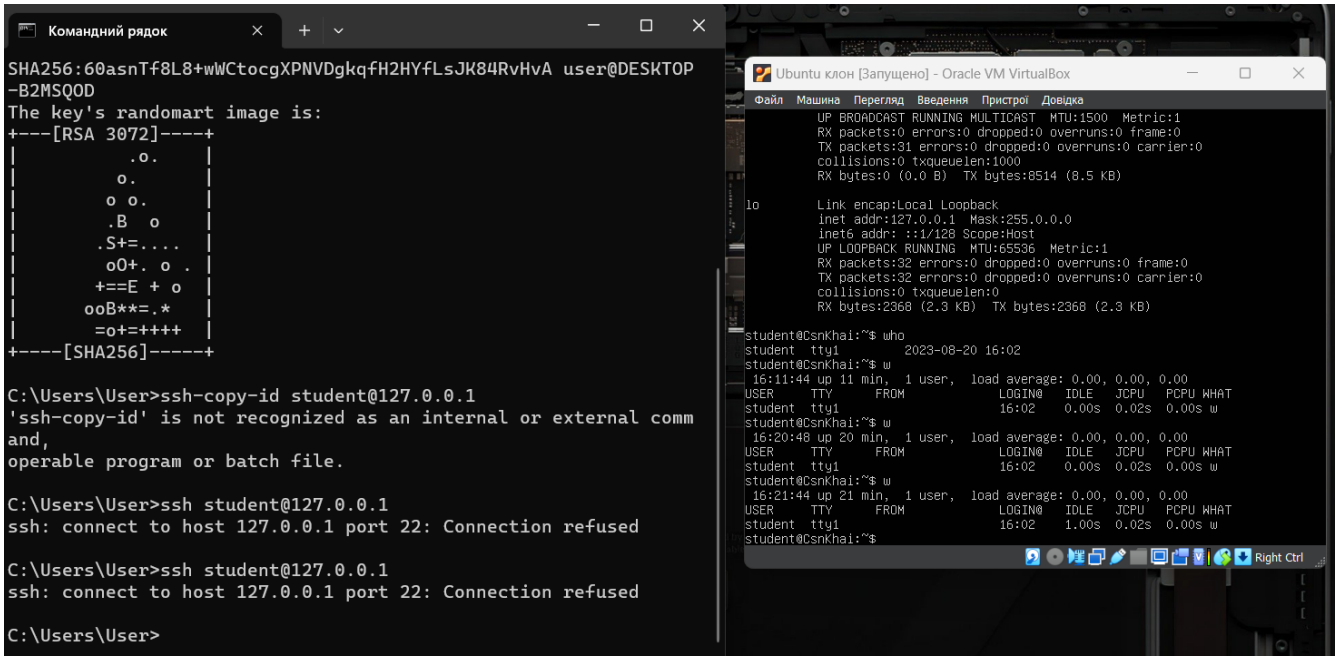
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
link/ether 08:00:27:d9:02:dc brd ff:ff:ff:ff:ff:ff
inet6 fe80::a00:27ff:fed9:2dc/64 scope link
valid_lft forever preferred_lft forever
student@CsnKhai:~$
Right Ctrl



3. List the options for choosing keys for encryption in SSH. Implement 3 of them.

1) RSA (Rivest-Shamir-Adleman):

RSA is one of the most widely used key types in SSH. It provides strong security and is well-supported by SSH clients and servers.

2) ECDSA (Elliptic Curve Digital Signature Algorithm):

ECDSA is a modern and efficient alternative to RSA. It uses elliptic curve cryptography to provide strong security with smaller key sizes.

3) Ed25519:

Ed25519 is another modern key type that offers high security and performance. It's designed to be resistant to various cryptographic attacks