

“Kyiv Vocation College of Communication”
Cyclical Commission of Computer Engineering

REPORT ON EXECUTION
LABORATORY WORK №4
on the discipline: "Operating Systems"

Topic: "Linux Commands for Process Management"

Performed by student
group RPZ-13a
Kateryna Hranat
Checked by teacher
V.S. Sushanova

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Work objectives:

1. Obtain practical skills in working with the Bash command-line interface.
2. Introduction to basic commands for process management.

Material Support for Classes:

1. IBM PC compatible computer.
2. Windows operating system and Virtual Box (Oracle) virtual machine.
3. GNU/Linux operating system (any distribution).
4. Cisco Networking Academy website [netacad.com](https://www.netacad.com) and its online courses on Linux.

Tasks for Preliminary Preparation:

1. Read the brief theoretical information for the laboratory work and create a small dictionary of basic English terms related to the purpose of commands and their parameters.

English terms	Ukrainian terms
Monitoring Programs	Моніторинг програм
Robustness	Надійність
The ps Command Unix Parameters	Параметри команди ps в Unix
Linux Process Signals	Сигнали процесів в Linux
The kill Command	Команда kill
The kill all Command	Команда killall

2. Based on the material covered, provide answers to the following questions:

2.1. *What commands for monitoring the status of processes do you know? How can you view their possible parameters?

- top: This command displays a list of processes in real-time. To view their parameters, you can use arrow keys to navigate up and down, as well as keys that correspond to sorting by different criteria.
- htop: An alternative to top that provides more detailed information and an interactive interface.
- ps: It displays the status of running processes. To view possible parameters, use command options, for example, ps aux or ps -ef.

2.2. *Can the ps command track the status of processes in real-time?

The ps command cannot track the status of processes in real-time. For this purpose, other tools such as top, htop, or specialized monitoring utilities like atop or glances are used.

2.3. **What parameters can be used for sorting processes in the top command? How do you switch between them?

- CPU: CPU usage by the process.
- MEM: Memory usage.
- TIME+: Total CPU time used by the process.
- PID: Process ID.
- PRI: Process priority.
- NI: Nice value of the process.
- %MEM: Percentage of memory usage.
- VIRT: Virtual memory size.
- RES: Physical memory used.
- SHR: Shared memory size.

To switch between these parameters in the top command, press the corresponding sorting keys. For example, pressing the 'M' key will sort processes by memory usage.

2.4. **What commands for terminating processes do you know?

- kill: This command is used to send a signal to a process. For example, kill PID will terminate the process with the specified PID.
- killall: Intended to terminate all processes with a specified name.
- pkill: Similar to kill, but can search for processes by their name or other attributes, not just by ID.

3. Read the material on working with processes in the terminal:

- Processes in Linux. Process Management
- Find out what processes are running in the background on Linux

Complete✓

4. Prepare an initial version of the report in electronic form:

- Title page, topic, and purpose of the work
- Glossary of terms
- Answers to points 5 and 6 from the tasks for preliminary preparation

Complete✓

Progress of Work:

1. Initial work in CLI mode in Linux OS of the Linux family:

1.1. Launch your Linux family operating system (if you are using your own PC and have it installed) and open the terminal.

2. Provide answers to the following questions:

- How to display the contents of the /proc directory? Where is it located and what is its purpose? Describe the information about its content.

- The /proc directory is a special virtual directory that contains information about processes and system resources. It is located at the root of the Linux filesystem.
- To display its contents, you can simply use the ls command: ls /proc.
- The purpose of the /proc directory is to provide an interface to kernel data structures. It allows users and processes to access various system information dynamically.
- The content of /proc includes information about running processes (in directories named with their process IDs), system configuration, hardware configuration, and more. Each file or directory within /proc corresponds to some aspect of the system, and reading from these files can provide insights into the system's state.

- How to display information about current user sessions? Which command can be used for this?

- The who command can be used to display information about current user sessions.
- Simply run who in the terminal to view a list of users currently logged in, along with details such as terminal, login time, and IP address.

- What actions can be performed in the terminal using the combinations Ctrl + C, Ctrl + D, and Ctrl + Z?

- Ctrl + C: Sends the SIGINT signal to the current foreground process, typically causing it to terminate.
- Ctrl + D: Signals an EOF (End-of-File) condition, which can trigger different behaviors depending on the context. For example, in a terminal session, it may close the session or terminate input.
- Ctrl + Z: Sends the SIGTSTP signal, which suspends (pauses) the current foreground process, returning control to the shell.

- *What is the difference between a background process and a regular one? Where are they used?

- A regular process runs in the foreground, meaning it takes control of the terminal and interacts directly with the user.
- A background process runs independently of the terminal, allowing the user to continue using the terminal for other tasks.
- Background processes are often used for long-running tasks or tasks that don't require user interaction.

- *Describe the following commands and explain what they do – the jobs, bg, fg commands.

- jobs: Lists the current jobs (background and suspended) associated with the current shell session.
- bg: Resumes a suspended background job, placing it in the background.
- fg: Brings a background job to the foreground, making it an active job.

- **Which command can be used to view information about background processes and tasks running in the system?

The jobs command is used to view information about background processes and tasks running in the system.

- **How to suspend a background process, then resume it, and if necessary, restart it?

- To suspend a background process, you can use Ctrl + Z.
- To resume it, use the fg command followed by the job ID.

- If necessary, to restart a background process, you can first terminate it using Ctrl + C or by using the kill command with the appropriate process ID, then start it again.

3. Launch the terminal and execute the following actions at the command line to familiarize yourself with process management:

- Run the command top, analyze the obtained results, and characterize the most active processes in the system.

```
top - 20:48:20 up 4 days, 6:49, 1 user, load average: 0.15, 0.30, 0.38
Tasks: 9 total, 2 running, 7 sleeping, 0 stopped, 0 zombie
%Cpu(s): 1.1 us, 0.3 sy, 0.0 ni, 98.6 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 65939852 total, 612916 free, 14279976 used, 51046960 buff/cache
KiB Swap: 8388604 total, 8388604 free, 0 used. 50955760 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
46	root	20	0	117720	22996	11816	R	3.6	0.0	0:00.21	check-ne+
26	bind	20	0	217060	18180	7028	S	0.5	0.0	0:00.05	named
58	sysadmin	20	0	38716	3256	2808	R	0.3	0.0	0:00.01	top
1	root	20	0	4388	788	728	S	0.0	0.0	0:00.08	init
7	root	20	0	78644	3656	3104	S	0.0	0.0	0:00.01	login
10	syslog	20	0	191336	3812	3312	S	0.0	0.0	0:00.96	rsyslogd
14	root	20	0	28368	2704	2440	S	0.0	0.0	0:00.00	cron
16	root	20	0	72312	3292	2548	S	0.0	0.0	0:00.00	sshd
47	sysadmin	20	0	19228	3976	2828	S	0.0	0.0	0:00.02	bash

Найбільш активні процеси можна визначити за великим значенням у стовпчику %CPU та %MEM.

- Suspend the execution of the top command (use a keyboard combination).

```
[1]+  Stopped                  top
sysadmin@localhost:~$
```

ctrl+Z

- Display information about processes using the ps command.

```
sysadmin@localhost:~$ ps
      PID TTY          TIME CMD
      47 pts/0        00:00:00 bash
      58 pts/0        00:00:00 top
      61 pts/0        00:00:00 ps
sysadmin@localhost:~$
```

- *Provide 5 examples using different parameters of the ps command (for example, display only system processes, display processes of a specific user, display process tree, etc.). Describe what exactly the selected parameters do.

Performed by student group RPZ-13a

Kateryna Hranat

Вивести тільки системні процеси: ps -e

```
sysadmin@localhost:~$ ps -e
  PID TTY          TIME CMD
    1 pts/0        00:00:00 init
    7 pts/0        00:00:00 login
   10 ?            00:00:00 rsyslogd
   14 ?            00:00:00 cron
   16 ?            00:00:00 sshd
   26 ?            00:00:00 named
   47 pts/0        00:00:00 bash
   58 pts/0        00:00:00 top
   62 pts/0        00:00:00 ps
sysadmin@localhost:~$
```

Вивести дерево процесів: ps -ejH

```
sysadmin@localhost:~$ ps -ejH
  PID   PGID   SID TTY          TIME CMD
    1     1     1 pts/0        00:00:00 init
    7     1     1 pts/0        00:00:00 login
   47   47     1 pts/0        00:00:00 bash
   58   58     1 pts/0        00:00:00 top
   65   65     1 pts/0        00:00:00 ps
   10   10    10 ?            00:00:00 rsyslogd
   14   14    14 ?            00:00:00 cron
   16   16    16 ?            00:00:00 sshd
   26   26    26 ?            00:00:00 named
sysadmin@localhost:~$
```

Вивести інформацію про всі процеси у вигляді дерева: ps -auxf

```
sysadmin@localhost:~$ ps -auxf
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.0   4388    788 pts/0    Ss   20:47   0:00 /sbin/init
root         7  0.0  0.0  78644   3656 pts/0    S   20:47   0:00 /bin/login -f
sysadmin   47  0.0  0.0  19228   4180 pts/0    S   20:48   0:00 \_ -bash
sysadmin   58  0.0  0.0  38716   3256 pts/0    T   20:48   0:00 \_ top
sysadmin   66  0.0  0.0  36712   3056 pts/0    R+  20:55   0:00 \_ ps -a
syslog    10  0.2  0.0 191336   3728 ?        Ss1  20:47   0:00 /usr/sbin/rsy
root       14  0.0  0.0   28368   2704 ?        Ss   20:48   0:00 /usr/sbin/cro
root       16  0.0  0.0   72312   3292 ?        Ss   20:48   0:00 /usr/sbin/ssh
bind       26  0.0  0.0 217060  18156 ?        Ss1  20:48   0:00 /usr/sbin/nam
sysadmin@localhost:~$
```

Performed by student group RPZ-13a

Kateryna Hranat

Вивести процеси конкретного користувача: `ps -u username`

```
sysadmin@localhost:~$ ps -u
USER          PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
sysadmin       47  0.0  0.0  19228  4180 pts/0    S   20:48   0:00 -bash
sysadmin       58  0.0  0.0  38716  3256 pts/0    T   20:48   0:00 top
sysadmin       64  0.0  0.0  34416  2864 pts/0    R+  20:54   0:00 ps -u
sysadmin@localhost:~$
```

Вивести повну інформацію про всі процеси: `ps aux`

```
sysadmin@localhost:~$ ps aux
USER          PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root           1  0.0  0.0   4388    788 pts/0    Ss   20:47   0:00 /sbin/init
root           7  0.0  0.0  78644  3656 pts/0    S    20:47   0:00 /bin/login -f
syslog        10  0.1  0.0 191336  3728 ?        Ssl   20:47   0:00 /usr/sbin/rsy
root          14  0.0  0.0  28368  2704 ?        Ss   20:48   0:00 /usr/sbin/cro
root          16  0.0  0.0  72312  3292 ?        Ss   20:48   0:00 /usr/sbin/ssh
bind          26  0.0  0.0 217060 18156 ?        Ssl   20:48   0:00 /usr/sbin/nam
sysadmin       47  0.0  0.0  19228  4180 pts/0    S    20:48   0:00 -bash
sysadmin       58  0.0  0.0  38716  3256 pts/0    T    20:48   0:00 top
sysadmin       67  0.0  0.0  34416  2952 pts/0    R+   20:56   0:00 ps aux
sysadmin@localhost:~$
```

- **Check if you have any background processes running, and if so, which ones?

```
sysadmin@localhost:~$ jobs
[1]+  Stopped                  top
sysadmin@localhost:~$
```

- **Resume the execution of a suspended background process first in the foreground, then suspend it again, and then resume its execution in the background.

Використовуйте команди `fg` та `bg` для відновлення та переключення фонового процесу. Наприклад, `fg %1` для відновлення на передній план, а потім `Ctrl + Z` для призупинення, і `bg %1` для відновлення на задній план.

```

KiB Swap: 8388604 total, 8388604 free, 0 used. 48760640 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM     TIME+ COMMAND
    1 root        20   0   4388    788    728  S   0.0   0.0   0:00.08 init
    7 root        20   0  78644   3288   2736  S   0.0   0.0   0:00.01 login
   10 syslog     20   0 191336   3680   3180  S   0.0   0.0   0:00.96 rsyslogd
   14 root        20   0  28368   2524   2260  S   0.0   0.0   0:00.00 cron
   16 root        20   0  72312   3208   2464  S   0.0   0.0   0:00.00 sshd
   26 bind       20   0 217060 17968   6816  S   0.0   0.0   0:00.05 named
   47 sysadmin   20   0  19228   4096   2892  S   0.0   0.0   0:00.03 bash
   58 sysadmin   20   0  38716   3208   2760  R   0.0   0.0   0:00.11 top

[1]+  Stopped                  top
sysadmin@localhost:~$ bg
[1]+  top &
sysadmin@localhost:~$

```

- Terminate the operation of this background process.

Для завершення роботи фонового процесу використовуйте команду kill %1, де %1 - ідентифікатор фонового процесу, який ви хочете завершити.

```

sysadmin@localhost:~$ kill %1
-bash: kill: (58) - No such process
[1]+  Done                  top
sysadmin@localhost:~$

```

Control questions

1. What is the purpose of the /proc directory in Linux systems? What information does it store?

The /proc directory in Linux systems is designed to provide access to information about various aspects of the system, such as processes, resources, hardware, etc. It contains virtual files that represent system resources, such as information about processes, memory, input/output, and more.

2. How to dynamically determine among any three processes which one currently utilizes the most memory? What percentage of memory does it consume compared to the total memory?

To determine the process utilizing the highest amount of memory among three, you can use the ps command and its parameters to display memory size information, or you can use other system monitoring tools like top or htop, which provide convenient interfaces for visualizing and managing processes.

3. How to obtain the hierarchy of parent processes in Linux systems?
Provide its structure and characterization.

To obtain the hierarchy of parent processes in Linux systems, you can use the pstree command. This command displays the process hierarchy in the form of a tree, where the root process is init (PID 1), and each subsequent process has its parent.

4. *What are the differences between the top command and ps?

The top command provides an interactive interface for real-time system monitoring, displaying a list of running processes with their respective resources. While the ps command outputs static information about processes, top allows tracking changes in the system in real-time and interacting with processes.

5. *What additional features does htop provide compared to top?

Compared to top, htop provides additional capabilities such as color-coding for better visual understanding, the ability to sort and filter processes, as well as the ability to manage processes directly from the user interface.

6. **Describe the components of your mobile OS for monitoring running processes.

Components of a mobile operating system for monitoring running processes may include system settings that allow tracking active processes, resource

analysis tools, and possibly monitoring applications that provide information about processes and their resource usage.

7. **Does your mobile OS support terminal-based process management?

Describe how.

Terminal-based process management in a mobile operating system can be implemented through the terminal or special applications that allow executing commands for managing processes, such as starting, pausing, resuming, and terminating.

8. **Is it possible to install third-party tools enabling management and monitoring of processes on your mobile phone? Briefly describe them.

Yes, it is possible to install third-party software tools for organizing process management and monitoring on a mobile phone. For example, applications that provide a graphical interface for monitoring processes or applications that allow remote management of processes over the network.

Conclusions:

During the course of the laboratory work, I acquired practical skills in working with the Bash command-line interface. I familiarized myself with basic commands for process management. I improved my English language skills. I prepared for the work, completed the assigned tasks, and answered control questions.