“Kyiv Professional College of Communications”

Computer Engineering Cycle Commission

**PERFORMANCE REPORT**

**LABORATORY WORK №2**

in the discipline: "Operating Systems"

**Topic: "Introduction to the basic commands of CLI-mode in Linux"**

Performed by students

RPZ-93B group

Team:

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**The goal of the work:**

1. Gaining practical skills in working with Bash and PowerShell command interpreters.

2. Familiarity with basic text commands in terminal mode in different operating systems.

**Material support of classes**

1. Computer type IBM PC.

2. Windows family of operating systems (Windows 7).

3. Virtual machine - Virtual Box (Oracle).

4. GNU / Linux operating system - CentOS.

5. Cisco Network Academy website netacad.com and its online Linux courses

**Tasks for preliminary preparation.**

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1. Read brief theoretical information for laboratory work and make a small dictionary basic English terms for assigning teams and their parameters.

|  |  |
| --- | --- |
| English | Ukrainian |
| ***pwd*** (*print working directory*) | Роздрукувати робочий каталог |
| ***cd*** (*change directory*) | Змінити каталог |
| ***man*** (*manual page*) | Сторінка посібника |
| ***man reboot*** | Людина перезавантаження |
| ***apropos*** | До речі |
| recursively descending | Рекурсивно спадний |

2. See demonstration materials on the peculiarities of working with the command line (see materials on

lab. jobs №2 https://drive.google.com/open?id=1DUnAmO5PNSorO7NT\_roIoFv3QksYoP-L):

- Command line input

- Command interpreters

- Basic Linux commands

- General information about working with the command line

- Getting information about teams

3. Study Cisco Academy Online Course Materials:

- NDG Linux Unhatched (Chapter 3, 4, 5, 6 and 15 all Topics)

- NDG Linux Essentials (Chapter 4 and 5 all Topics)

4. Take the NDG Linux Essentials course on the following topics:

- Chapter 04 Exam

- Chapter 05 Exam

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5. Define the following concepts:

- Command interpreter

A command interpreter is the part of a computer [operating system](https://whatis.techtarget.com/definition/operating-system-OS) that understands and executes commands that are entered interactively by a human being or from a program. In some operating systems, the command interpreter is called the [shell](https://www.techtarget.com/searchdatacenter/definition/shell).

- Console  and terminal

**Console** is a basic computer or monitor and [keyboard](https://www.computerhope.com/jargon/k/keyboard.htm) that is connected to another computer, server, or a mainframe over a network. It is used to maintain or monitor the status of the network or computer.

The **terminal** is an interface that allows you to access the command line. To open the terminal on an Apple computer, click the terminal icon (shown to the right) on your [Dock](https://www.computerhope.com/jargon/d/dock.htm).

- CLI-mode

A **command-line interface** (**CLI**) processes [commands](https://en.wikipedia.org/wiki/Command_(computing)) to a computer program in the form of lines of text. The program which handles the interface is called a **command-line interpreter** or **command-line processor**.

6. Answer the following questions:

- How in the Linux terminal you can find information about the command, its purpose and parameters?

The apropos command is used to find and display a short command / program help page as follows: $ Apropos adduser

- What is the purpose of the ls and pwd commands?

Command ls.Display the contents of the current directory (or any other directory you specify) and provide information about its files. After the command we specify the directory for which it is necessary to look filling, if it is necessary to learn for the current directory then the command without additional arguments will be enough. Frequently used options with this command: -a - to display all files, including hidden, and the option -l - to display additional information about files (eg, access rights, owner, creation date, etc.).

The pwd (short for print working directory) command literally translates as "output working directory". The translation immediately defines and clearly explains the purpose of the command, the purpose is to display the path to the directory in which currently performs actions or just the user. The path will be output absolute, starting with the symbol /. It is convenient to use to determine the exact path of the directory for further action on it. pwd has a simple syntax and in most cases is used without adding options.

- What is the purpose of the more, less and cat commands in a Linux terminal? What parameters they may have.

The more command allows you to view relatively long text files on a single screen. $ More file.txt

Less-page-by-page file or standard input. $ Less file .txt

Cat allows you to view the contents of a file or data presented and displayed in a terminal. $ Cat file.txt

7. Prepare in electronic form the initial version of the report:

- Title page, topic and purpose of the work

- Glossary of terms

- Answers to item 5 and item 6 of the tasks for preliminary training

**Progress.**

1. Initial work in CLI mode in Linux Linux family:

1. Start the VirtualBox virtual machine, select CentOS, and start it. Log in under the user: CentOS, login password: reverse (if you are performing LR in room 401) and lower the terminal.
2. Start the Ubuntu\_PC virtual machine (if you are performing LR tasks through the netacad academy).
3. Start your Linux operating system (if you are running on your own PC and have it installed) and start the terminal

2. Study all the examples of commands presented in the laboratory work of the course NDG Linux Essentials - Lab 5: Command Line Skills.

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3. Create a table of commands studied in paragraph 2 of the course of work as follows:

|  |  |
| --- | --- |
| Name of the command | Its purpose and functionality |
| **/etc** | Configuration files location |
| **/home** | Home or user profile directories |
| **/proc** | System runtime information |
| **/root** | Home directory for root user (system admin) |
| **/tmp** | Temporary files location |
| **/var/log** | Log files location |
| **apropos** | Search for help on commands by title |
| **bash** | The Bourne-again shell |
| **cat** | Concatenate the input files to stdout |
| **cd** | Change the current directory |
| **cp** | Copy files or directories |
| **df** | Show space utilization by filesystem |
| **dig** | Look up DNS info on an address |
| **du** | Estimate disk usage |
| **find** | Find files based on various conditions and execute actions against the results |
| **grep** | Search for a pattern (regular expression) in files |
| **less** | Display the file one page at a time on stdout |
| **locate** | Locate files by name |
| **ls** | List directory contents |
| **man** | Display manual pages; remember, q quits |
| **ps** | List running processes |
| **pwd** | Print the current (working) directory name |
| **scp** | File copy over Secure Shell protocol |
| **smbclient** | Copy files to and from Windows using the SMB/CIFS (Windows file share) protocol |
| **ssh** | Secure Shell terminal program and protocol |
| **tail** | Display the last lines of a file |
| **top** | List processes by resource utilization (CPU) |
| **whois** | Look up DNS ownership info on an address |
| **ifconfig** | Display network (interface) configuration |
| **kill** | Terminate a process |
| **ping** | Test for network connectivity to an IP address |
| **reboot** | Restart the system |
| **shutdown** | Shut down or restart the system |
| **sudo** | Execute a command with elevated privileges |
| **traceroute** | Trace the route to an IP address |

1. What commands to get help on commands in the terminal you know. Using the example of the uname command, demonstrate how to get help on its parameters and give 5 different options for outputting information on this command (explain the difference between them).

*-whereis - displays the path to executable files.*

*-man - shows help or team leader, used in a one-page command.*

*-whatis is similar to the above command, but it is used to display existing help sections.*

The command syntax uname takes the following form:

uname [OPTIONS]...

You don't have to remember all the command line options. Typically uname the command is used with the -a option to print all available information:

uname -a

Linux dev.linuxize.com 4.19.0-6-amd64 #1 SMP Debian 4.19.67-2+deb10u1 (2019-09-20) x86\_64 GNU/Linux

The output includes the following information:

* Linux- Kernel name.
* dev.linuxize.com- Host name.
* 4.19.0-6-amd64Kernel release.
* #1 SMP Debian 4.19.67-2+deb10u1 (2019-09-20)- kernel version.
* x86\_64- The name of the equipment of the machine.
* GNU/Linux- The name of the operating system.

The command uname is used to print basic system information. Usually called with the -a ability to display all available information.

The following options are possible:

* -s, ( --kernel-name) - prints the kernel name.
* -n, ( --nodename) - prints the hostname of the system (hostname). This is the name the system uses when communicating over the network. When used with -n an option uname , produces the same output as the hostname command.
* -r, ( --kernel-release) - Prints the kernel release.
* -v, ( --kernel-version) - prints the kernel version.
* -m, ( --machine) - prints the machine's hardware name.

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5. Working with "environment variables" in the terminal:

• What are environment variables? What they are. How can they be viewed in the terminal?

• What is the prompt in the terminal before each command?

• Describe the variable $ PS1. How to view its contents in the terminal?

• How can I change the value of the $ PS1 variable? What will happen in the prompt line in bash (prompt line before each command). How to change the value of this variable not to the current session, but by default? Demonstrate your examples.

• What is the difference if there is a $ or # character at the end of the bash prompt line?https://lh6.googleusercontent.com/hs6JLGEJJSzFs9WqaEnwMiQiW3dEyCVZcAGi2Agn_uN1CEWmco4owhAzW4n7Zf2O0eiMNok7OaIlUOZ6BCh1XdIvBrDOyEdPmTYWNToEJSokGUco60WP1blmaMSC_4-koB_GBFs

https://lh5.googleusercontent.com/De5nZoM0O2XGblMyw92ePlT_F3UooWyuj7IB7-Xylvvvrs-49-UImDzQfbXJzr50cjnGuY3Vs7DM7tgdCAYqpepxGsG4Uxy-jUpyWvj0xF1tezf8zR0frb2W4HHJrAXgO61L5ks

5.1) Environment variables are a set of key-value pairs stored in Linux and are used by processes to perform certain operations. They are responsible for the standard behavior of the system and applications.

5.2) There are two types:

1- User environment variables - save settings specific user, for example, specify the path to user directories.

2- System variables - store data about some OS directories and computer configurations.

5.3) You need to open a terminal and write the command sudo apt-get install coreutils to check go for the availability of the utility and install it if necessary. Once installed you need to use one of the command utilities. Type printenv and press Enter. To the console will be output data. The expression before the sign '=' is the name of the variable, followed by its value.

5.4) What is written before the $ or # sign is the same sign. It's all called together command line prompt. Typically, it includes the address of the folder in which is a user. It invites the user to enter a command in the window.

5.5) The primary PS1 prompt indicates that the interpreter is ready to enter the command. The value of the PS1 environment variable determines the appearance of the command line prompt. Completion of the session has the form $ or #. The default is the default the invitation looks like: "[\ u @ \ h \ W] \ $", i.e. username @ hostname Current open directory.

For example: user @ server ~ $, where tilde is the name of the user's home directory. There are several special characters that consist of a slash and a letter or sign,the inclusion of which in the command line prompt affects its appearance. Change the value PS1 is executed using the export command, as is changing any environment variable.

For example: export PS1 = "\ u @ \ w:". Result: user @ ~:.

5.6) You can use the echo command to find out the current value of this variable.

For example: echo $ PS1.

5.7) To preserve the primary appearance of the PS1 variable, for this knowledge of this variable can be copied to another variable.

For example: [me @ linuxbox ~] $ PS1 \_virgin = "$ PS1".

You can check the result of copying the values ​​of one variable to another using the echo command:

[me @ linuxbox ~] $ echo $ PS1\_virgin

[u @ h W] $.

5.8) The end of the invitation for regular users is "$" and "#" is for superusers.

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6. Match the commands and actions they perform. Demonstrate examples of their implementation in the terminal with different parameters (2-3 examples for each command):

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1. date command |  | g. shows the current date and time, according to the system clock of the kernel |
|  | 2.command cal |  | d. prints a calendar (user-friendly) |
|  | 3. hwclock command |  | e. displays the integrated clock |
|  | 4. uptime command |  | l. shows the current time and operation of the system (session duration, number users, etc.) without rebooting and shutting down |
|  | 5. uname command |  | i. displays information about the current unix system |
|  | 6. hostname command |  | a. command shows the network name of the computer |
|  | 7.command ls |  | h. displays a list of files and directories in order |
|  | 8.command dir |  | m. shows the contents of your current directory in alphabetical order and case sensitive |
|  | 9. users command |  | c. Displays a list of users working in the current session |
|  | 10.who command |  | j. shows system users |
|  | 11.whoami command |  | o.Displays the current personal number of the user working in this terminal |
|  | 12.command pwd |  | f. displays the current path |
|  | 13. command  history |  | k. shows a numbered list of commands that you executed in this and the last session |
|  | 14. ifconfig command |  | n. displays the status of the current network configuration or configures network interface. |
|  | 15.command clear |  | b.cleans the terminal screen |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

7. Describe the actions performed by commands to move through the directory system:

• command cd / -takes you to the root directory of the entire system

• command cd / home - takes you to the home directory, which contains the user directories

• command cd ~ - also takes you to your home directory

• command cd .. - takes you one level up

• command cd ../ .. - move up two levels

• command cd– - go back to previous working directory

8. Compare the capabilities of commands to shut down your computer. In which case it is more expedient to use each of them? Is it possible to replace one team with another? Demonstrate examples of using these commands to perform the following steps

|  |  |  |  |
| --- | --- | --- | --- |
|  | Team |  | Actions (some of them can be implemented by several different commands) |
|  | reboot |  | В) Restart the computer |
|  | shutdown |  | А) Shutting down the computer at 5 p.m. |
|  | poweroff |  | С) Urgently shut down the computer |
|  | halt |  | С) Urgently shut down the computer |

Often, the shutdown utility is used to shut down Linux from the terminal. There are also poweroff, halt commands, but they are for non-standard cases. Naturally, the shutdown command in Linux or any other does not automatically shut down the system and turn off the computer. It just passes the shutdown request to the init system and then to the kernel. And already they perform a number of complex operations to prepare and turn off the computer. In short, here they are:

End user processes.

Signal SIGTERM to all processes.

Signal SIGKILL to all processes.

Mounting filesystems in read-only mode.

Preparing external devices for shutdown.

User space lock to ensure that no more user code is run.

Shutdown and power off most peripheral devices.

Power off the computer.

$ shutdown [options] [time] [message]

The options set the disable parameters, we will discuss them below. Time can be set as hh:mm in 24 hour format. You can also use the +minutes entry to indicate how many minutes from now you want to shut down your Linux machine. The now constant is also available, indicating that you need to turn it off right now. The message parameter allows you to specify a message that will be displayed in the terminal before shutdown.

Here are the main utility options:

--help - display help for the program

-H, --halt - power off without terminating processes or remounting filesystems

-P, --poweroff - normal shutdown

-r, --reboot - reboot

-k - do not perform real actions, but only display a message

--no-wall - turn off the computer, but do not display a message

-c - cancel scheduled linux shutdown from command line.

* 1. shutdown. Example:  $ sudo shutdown -h now
  2. reboot. Example:  $ sudo reboot -p

The reboot command is usually used to reboot the system, but it can also shut down the computer. To turn it off, you need to specify the -p option.

* 1. halt. Example: $ sudo halt

This command also shuts down the computer. She just does it in her own way. It does not perform any preparatory actions before shutting down, but simply turns off the power.

* 1. poweroff. Example: $ sudo poweroff

This is an analogue of halt, does exactly the same.

**Test questions**

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1.How can I change the appearance of the terminal (color, size, fonts, etc.) in Linux at the request of the user?

You can install the dependency for setting up the terminal by typing the command: $ sudo pacman -S fish vim ranger terminology radare2 cmatrix.

After that, you can easily change the color or type of the terminal to your taste and color.

2.Describe the concept of "virtual console" in Linux. How many active virtual consoles can be in the process of running Linux by default. How to call them and switch between them? Give examples?

A virtual console is a conceptual combination of a keyboard and display to provide a user interface. One console can be divided into several, for example, the upper part will be occupied by the main part, and the lower one can be divided, for example, into 2 parts. Using the two lower parts of the terminal, you can write notes or open auxiliary programs.



**Example**

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3. Which virtual console serves as a graphical shell?

За останнім(шостим) віртуальним терміналом знаходиться графічний інтерфейс, для перемикання в нього (якщо він запущений) можна натиснути клавіші Ctrl+Alt+F7; або Ctrl+Alt+F8.

4. \*\*\* How to switch to graphical / console mode manually by the user using commands in the terminal. How can I configure the system boot only in console mode, and only if necessary (on command) to go to the graphics?

When Ubuntu boots, seven full-screen consoles are launched, each with its own independent session, the first to sixth with a command line interface, and the seventh running graphical mode. The user sees only the graphics mode during the download.  
You can switch to one of the virtual consoles by pressing the key combination:  
Ctrl + Alt + F1 - the first [virtual console](https://sukachoff.ru/uk/remont/upravlenie-virtualbox-s-pomoshchyu-konsoli-zapusk-virtualnoi-mashiny-v-virtualbox-bez-gui/) ;  
Ctrl + Alt + F2 - the second virtual console;  
Ctrl + Alt + F3 - the third virtual console;  
Ctrl + Alt + F4 - the fourth virtual console;  
Ctrl + Alt + F5 - the fifth virtual console;  
Ctrl + Alt + F6 - the sixth virtual console;  
Ctrl + Alt + F7 - the seventh virtual console, return to graphics mode.

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1. \*\*\* Is it possible to log in to Linux several times under the same system name? What benefits can this provide?

The fact that Linux is a multi-user and multi-tasking system is manifested not only in the differentiation of access rights, but also in the organization of the workplace. Each computer that runs Linux provides the ability to register and access the system at the same time for several users. Even if all users have only one monitor and one system keyboard at their disposal, this feature is useful: simultaneous registration of several users in the system allows you to work in turn without having to complete all started tasks each time (close all windows, interrupt the execution of all programs) and then resume them. Moreover, nothing prevents you from registering in the system several times under the same login name. Thus, you can access the same resources (your files) and organize parallel work on several tasks.

1. \*\*\* Describe the concept of tty in Linux. How is it related to virtual consoles?

The TTY subsystem, or TTY abstraction, is one of the foundations of Unix or Unix-like operating systems, in particular Linux. This system is intended for the use of one terminal by several processes, some input possibilities (for example, sending signals with special keys, deleting entered characters).

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**Conclusion:** After doing this laboratory work, I gained practical skills in working with Bash and PowerShell command interpreters.Familiarized with basic text commands in terminal mode in different operating systems. And learned a lot of new things.