“Київський фаховий коледж зв’язку”

Циклова комісія Комп’ютерної інженерії

**ЗВІТ ПО ВИКОНАННЮ**

**ЛАБОРАТОРНОЇ РОБОТИ №4**

з дисципліни: «Операційні системи»

**Тема: “Команди Linux для управління процесами”**

Виконали студенти

Групи КСМ – 13а

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Перевірив викладач

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Київ 2022

**Мета роботи:**

**1. Отримання практичних навиків роботи з командною оболонкою Bash.**

**2. Знайомство з базовими командами для управління процесами.**

**Матеріальне забезпечення занять**

**1. ЕОМ типу IBM PC.**

**2. ОС сімейства Windows (Windows 7).**

**3. Віртуальна машина – Virtual Box (Oracle).**

**4. Операційна система GNU/Linux – CentOS.**

**5. Сайт мережевої академії Cisco netacad.com та його онлайн курси по Linux**

**Завдання для попередньої підготовки**

***Готував матеріал студент Бродзінський Є.В.***

1. Прочитайте короткі теоретичні відомості до лабораторної роботи та зробіть невеличкий словникбазових англійських термінів з питань призначення команд та їх параметрів.

|  |  |
| --- | --- |
| **Термін англійською** | **Термін українською** |
| Command | Команда |
| Parameter | Параметр |
| Argument | Аргумент |
| Value | Значення |
| Type | Тип |
| Mode | Режим |
| Quoting | Опція |
| Flag | Прапорець |
| Switch | Перемикач |
| Execute | Виконати |

2. На базі розглянутого матеріалу дайте відповіді на наступні питання:

2.1. Які команди для моніторингу стану процесів ви знаєте. Як переглянути їх можливі параметри?

ps - displays a list of processes that are currently running on the system.

top - displays a list of real-time processes, including their CPU, memory, disk, and network.

htop - graphical version of the top command.

pidstat - displays statistics about processes, including CPU, memory, disk and network.

sar - displays statistics about the system as a whole, including processes, memory, disk and network.

2.2. Чи може команда ps у реальному часі відслідковувати стан процесів?

No, the ps command cannot monitor the state of processes in real time. It displays static information about the processes that are currently running in the system.

2.3. За якими параметрами можливе сортування процесів в команді top? Як переключатись між ними?

In the top command, you can sort processes by the following parameters:

PID - process number.

CPU% - percentage allocation of the processor.

MEM% - percentage allocation of memory.

VSZ - virtual memory size.

RSS - real memory size.

TTY is the pseudo-terminal to which the process is bound.

STAT - state of the process.

PRI - process priority.

NI - non-privileged process.

WCHAN - state of the process in the scheduler.

COMMAND is the name of the process.

Key combination:b - switches between ascending and descending sorting modes.

2.4. Які команди для завершення роботи процесів ви знаєте?

The “KILL” command to signal the process to terminate it;

“killall” command is to terminate all processes;

Command “QUIT” Stops running.

3. Прочитати матеріал про роботу з процесами та використання клавіш у терміналі:

- Ctrl + C, Ctrl + D, Ctrl + Z

- Find out what processes are running in the background on Linux

4. Підготувати в електронному вигляді початковий варіант звіту:

- Титульний аркуш, тема та мета роботи

- Словник термінів

- Відповіді на п.2.1-2.4 з завдань для попередньої підготовки

**Хід роботи**

1. Початкова робота в CLI-режимі в Linux ОС сімейства Linux:

1.1. Запустіть віртуальну машину VirtualBox, оберіть CentOS та запустіть її. Виконайте вхід в систему

під користувачем: CentOS, пароль для входу: reverse (якщо виконуєте ЛР у 401 ауд.) та запустіть

термінал.

1.2. Запустіть віртуальну машину Ubuntu\_PC (якщо виконуєте завдання ЛР через академію netacad)

1.3. Запустіть свою операційну систему сімейства Linux (якщо працюєте на власному ПК та її

встановили) та запустіть термінал.

***Готував матеріал студент Бродзінський Є.В.***

2. Дайте відповіді на наступні питання:

- Як вивести вміст директорії /proc? Де вона знаходиться та для чого призначена?

Охарактеризуйте інформацію про її вміст?

ls /proc - a command to display the contents of the /proc directory. The /proc directory is located in the Linux root file system, information from the /proc directory can be used to monitor the operation of processes and to diagnose problems. For example, you can use the ps or top commands to view process information from the /proc directory.

Information about its content:

Process ID (PID)

The name of the process

Process status

Process privileges

Memory in use

Used resources

Each file in the /proc directory contains some information about a process. For example, the file /proc/<PID>/cmdline contains a list of arguments that were passed to the process when it started. The file /proc/<PID>/status contains information about the status of the process, including its priority, non-privileges, and used resources.

- Як вивести інформацію про поточні сеанси користувачів. Якою командою це можна зробити?

To do this, we need the "who" command. To do this, we need to open a terminal and enter the "who" command, and we will be able to see a list of active user sessions.

- Які дії можна зробити в терміналі за допомогою комбінацій 1)Ctrl + C, 2)Ctrl + D та 3)Ctrl + Z?

1)With the help of this combination Ctrl + C: we can interrupt (or terminate) the execution of the current command or process in the terminal

2) The Ctrl + D combination indicates that the command is finished and the terminal should close.

3) Ctrl + Z: key combination used to stop the current process and put it in background mode.

- Чим відрізняється фоновий процес від звичайного. Де вони використовуються?

Difference between background process and normal process:

1) Display in the terminal:

A normal process (foreground) displays its output and accepts input in the terminal from which it was launched. The user sees this process and can interact with it by typing commands into the terminal.

The background process does not interact with the terminal from which it was launched. The output of the background process is not displayed in the current terminal, and the user can continue to type commands into the terminal regardless of the background process.

2)Usage:

Common processes are used to run commands and programs that the user wants to actively interact with. For example, a text editor or calculations that the user monitors and controls. Background processes are used to perform tasks that can run in the background without active user involvement. It can be, for example, a background service that checks mail, archives files, or performs regular tasks without the need for user interaction.

3) Termination:

A normal process terminates when it completes its work or when the user manually sends a termination signal (such as Ctrl + C). A process can wait for user input or terminate after execution is complete. A background process can continue to run even if the user exits the terminal from which it was started. The background process can be controlled using special commands for background processes: bg, fg, jobs.

- Опишіть наступні команди та поясніть що вони виконують – команда jobs, bg, fg.

Command ”jobs” - displays a list of all current background processes.

Command ”bg” - it brings the background process to the foreground.

Command ”fg” - brings the background process to the foreground and makes it current.

- Якою командою можна переглянути інформацію про запущені в системи фонові процеси та задачі?

We can view information about background processes and tasks running on the system using the jobs command.

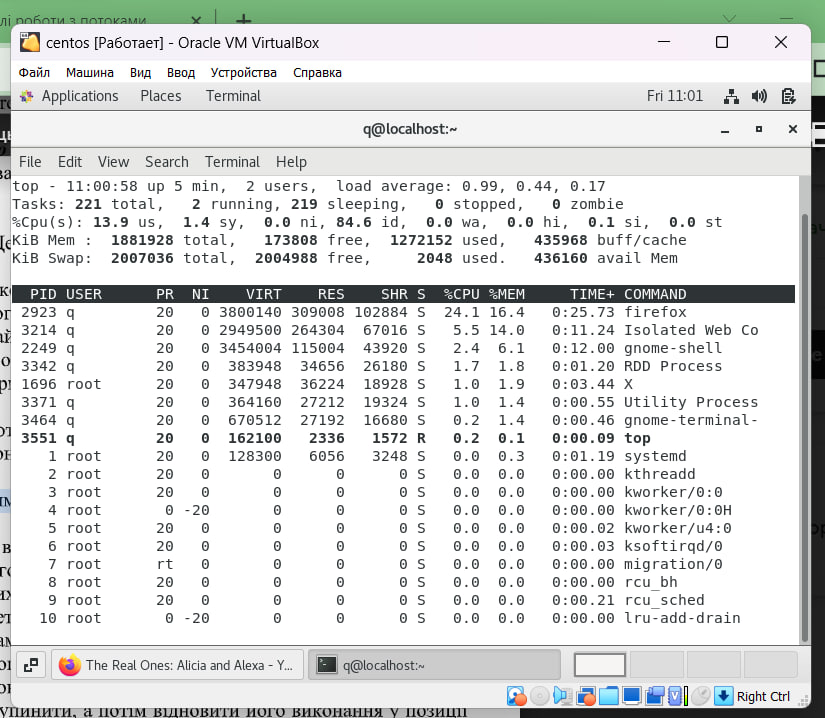
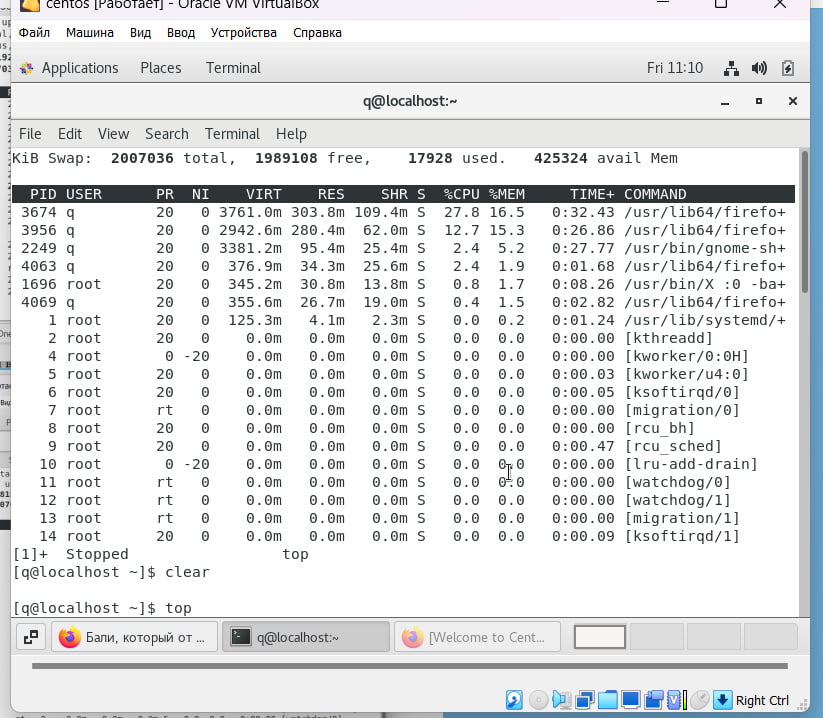
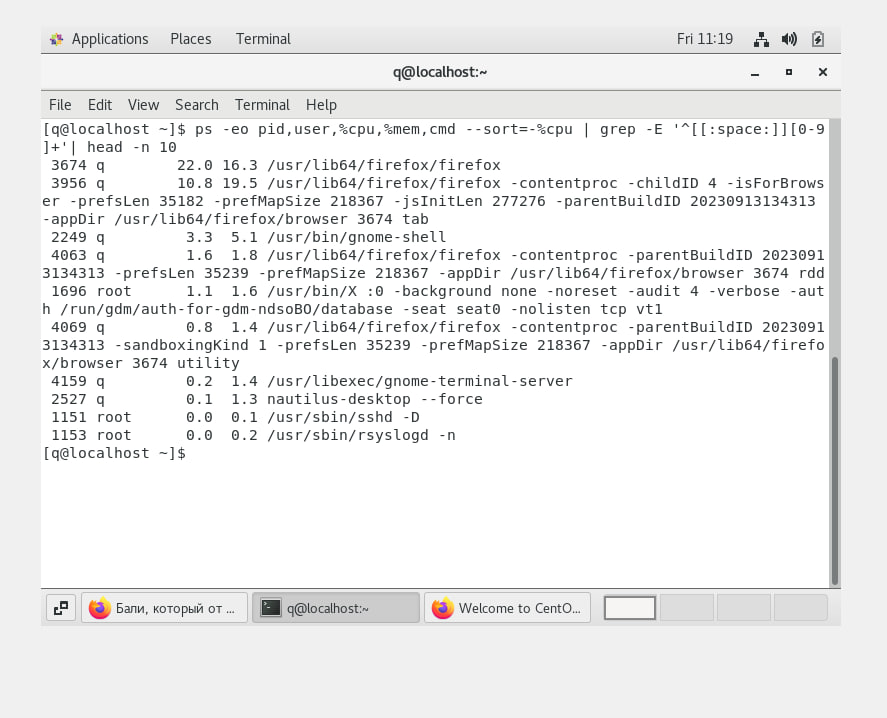
- Як призупинити фоновий процес, як його потім відновити та при необхідності перезапусти?

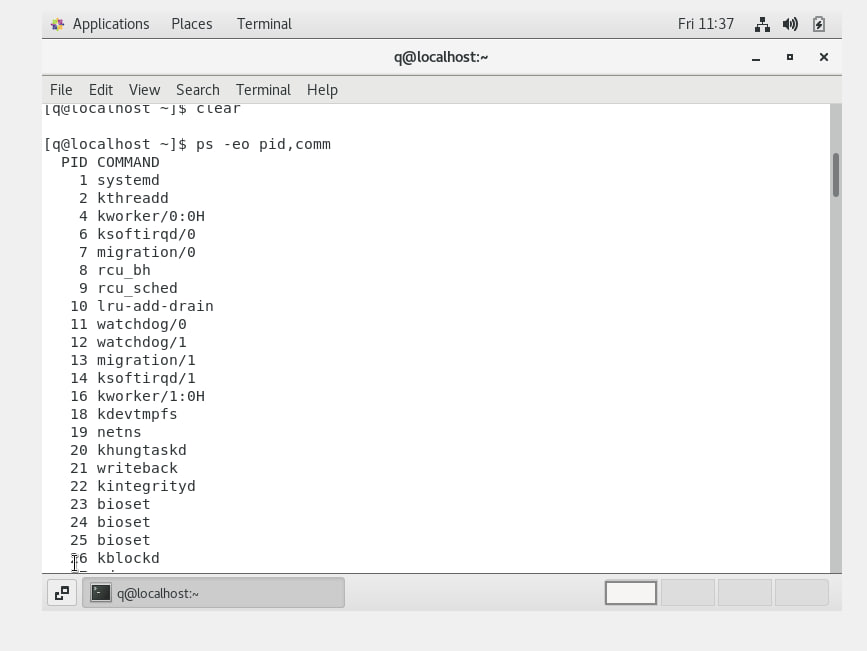
In order to suspend the background process, you can use the Ctrl+Z key combination. This will pause the process and put it in the "Stopped" state.

To resume the suspended background process later, we also use the fg command. This will bring the process to the foreground and make it current.

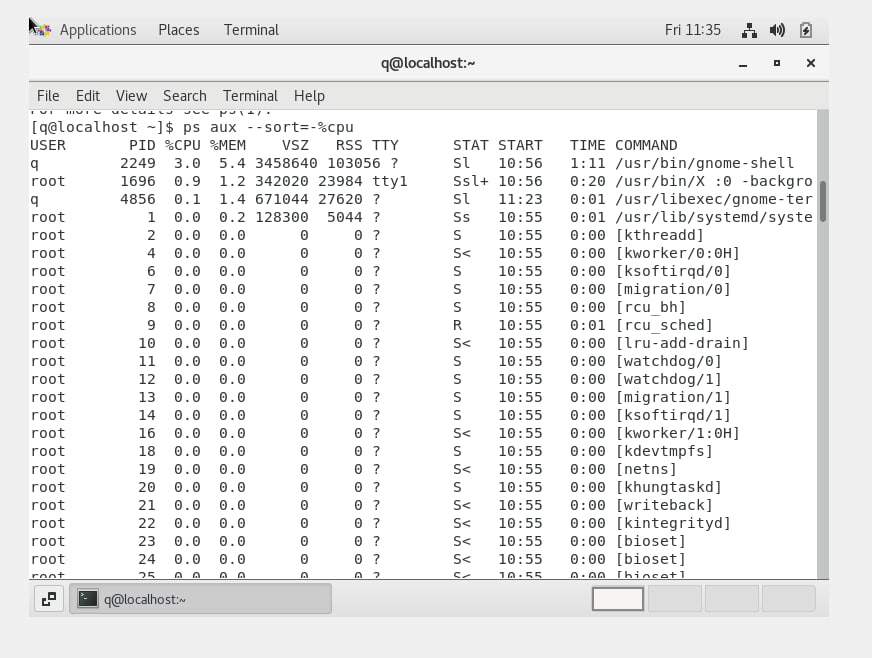
To restart a suspended background process, you can use the fg -r command. This will bring the process to the foreground and make it current, then restart it.

3.Launched the terminal, and in the command line performed the following actions:

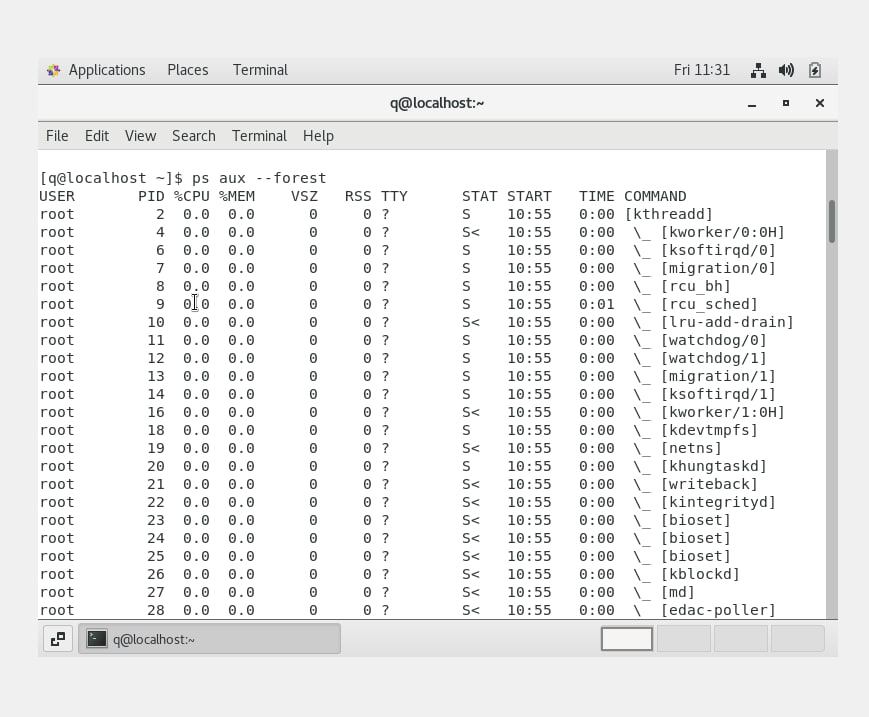
* ran the top command
* suspended execution of the top command (key combination must be used);
* displayed information about processes using the ps command;
* 5 examples using different parameters of the ps command



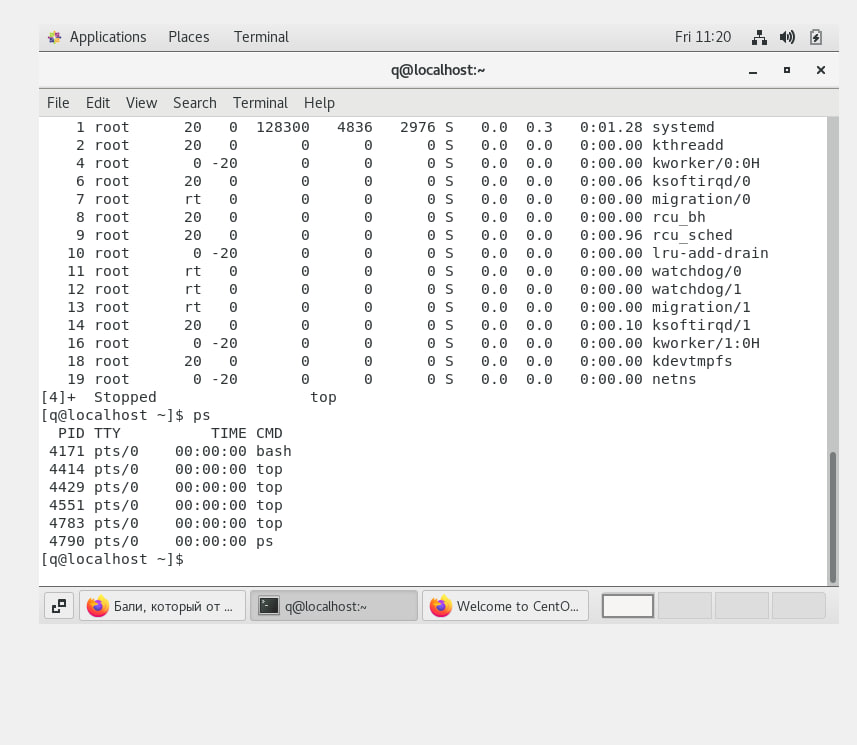
Output only process names and their PIDs



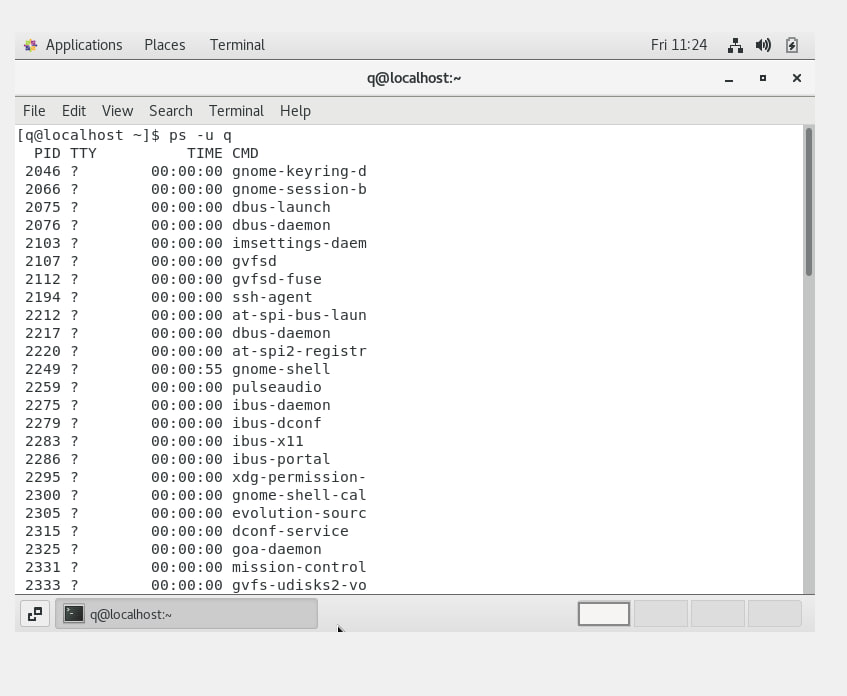
Display information about all processes and sort them by CPU usage in descending order



Process tree

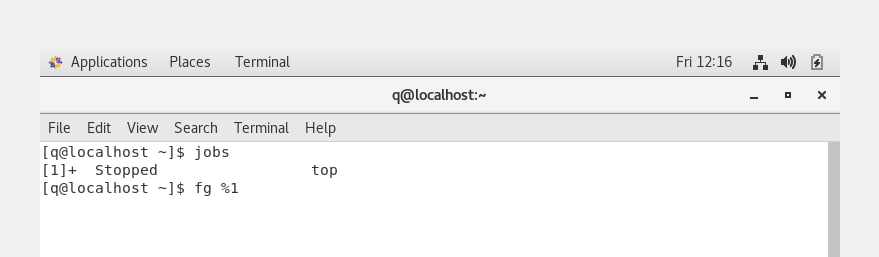


System processes

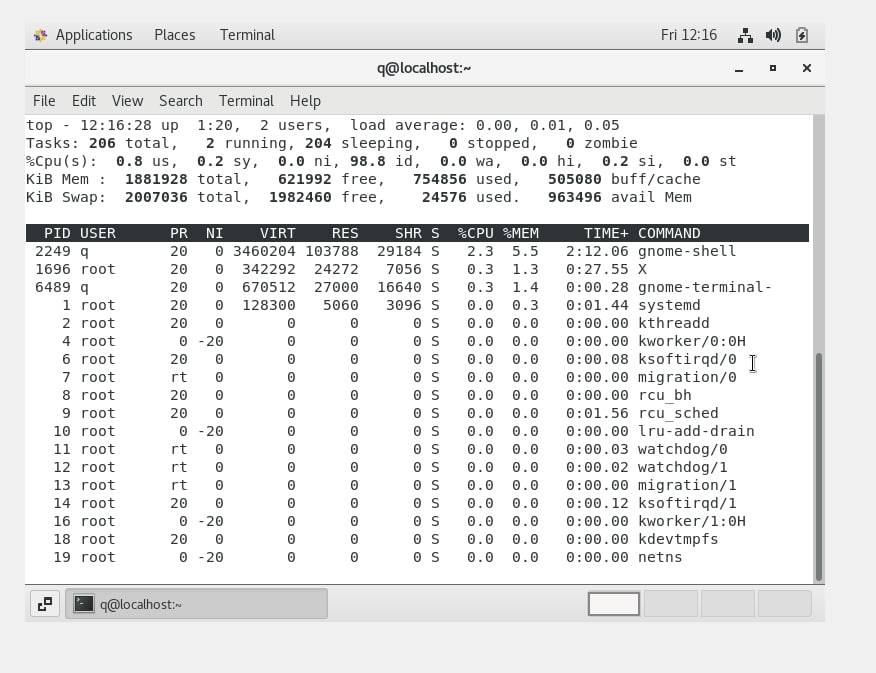


Processes of a specific user

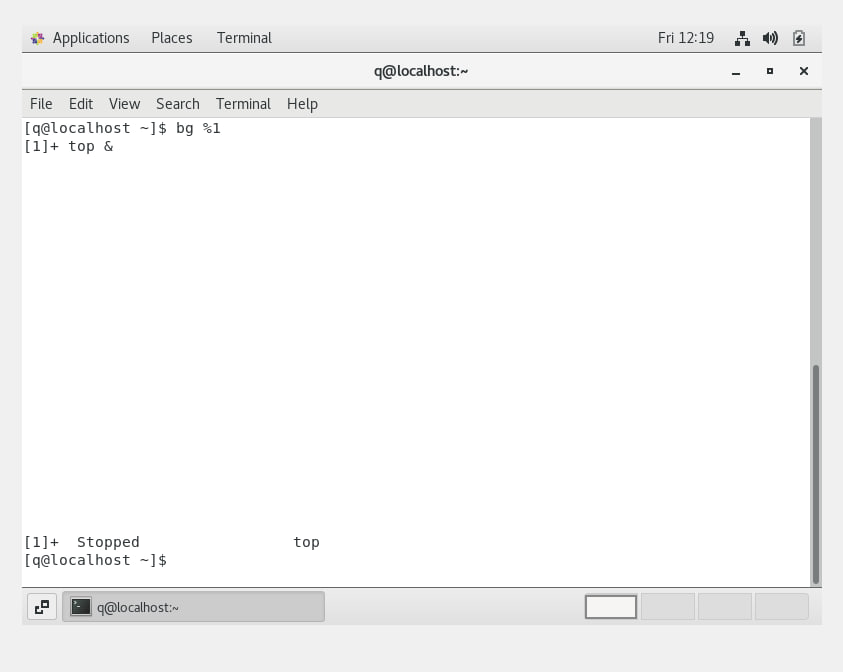
* checked to see if I have background processes running, which ones?



* resumed the execution of the suspended background process first in the "foreground" position, then suspend it again, and then resume its execution in the "background" position



* terminate this background process



**Контрольні запитання**

**Виконав: Кравченко Тарас**

1. **Яке призначення директорії /proc в системах Linux. Яку інформацію вона зберігає?**

1. \*\*Access to System Information\*\*: The /proc directory provides access to crucial system information, such as details about processes, the kernel, and system resources.

2. \*\*Process Information\*\*: Within this directory, there are subdirectories, each corresponding to an individual process in the system. These subdirectories contain information about the process, including its Process ID (PID), status, memory usage, open files, and more.

3. \*\*Kernel Configuration Management\*\*: /proc allows for reading and writing various kernel parameters, including task scheduler settings, resource limits, event tracking, and many others.

4. \*\*Statistics Collection and Diagnostics\*\*: This directory provides statistical information on resource usage, system load, and other parameters that can be used for system monitoring and diagnostics.

5. \*\*Other System Information\*\*: /proc also contains additional files and folders that offer information on hardware details, network settings, kernel configuration, and more.

In summary, /proc serves as an interface for accessing a wide range of real-time system information, presented in the form of pseudo-files and directories. It is used for system monitoring, configuration, and diagnostics in the Linux operating system.

2**. Як серед будь-яких трьох процесів динамічно визначати, який з них в поточний момент часу**

**використовує найбільший обсяг памяті? Який відсоток пам’яті він споживає від загального обсягу?**

To determine which of the three processes currently uses the most memory, you can use the `top` or `htop` command. These utilities provide information about resource consumption by processes, including memory.

Here's how to use the `top` command:

1. Open a terminal.

2. Enter the command `top` and press Enter.

3. At the top, you will see information about the total system memory usage.

4. In the process table below, you will see a list of all running processes. They are sorted by various criteria. By default, they are sorted by CPU usage.

5. To sort processes by memory usage, press the `Shift` + `M` keys.

6. Review the list of processes by memory size and identify the process that uses the most memory.

Regarding the percentage of memory used by this process, you can see this in the "VIRT" (virtual memory) or "RES" (resident memory) column for each process in the table. Virtual memory includes all available memory for the process, while resident memory shows the actual amount of physical memory the process is using.

The percentage of memory can be calculated with the formula:

\[Memory Percentage = (\text{Resident Memory} / \text{Total Physical Memory}) \times 100\]

You can check the total physical memory using the `free -m` command.

**3. Як отримати ієрархію батьківських процесів в системах Linux? Наведіть її структуру та охарактеризуйте.**

To obtain the hierarchy of parent processes in Linux systems, you can use the `pstree` command. This command visualizes the process hierarchy in a user-friendly format.

Here's an example of how to use the `pstree` command:

1. Open a terminal.

2. Enter the command `pstree` and press Enter.

3. You will see the process hierarchy represented as a tree. The root process (PID 1), typically named `init` or `systemd`, is the parent process for all other processes in the system. Other processes are organized in the tree according to their parent-child relationships.

The structure of the parent process hierarchy looks something like this:

```

init/systemd(PID 1)

└─ process\_1

└─ subprocess\_1\_1

└─ subprocess\_1\_2

└─ process\_2

└─ process\_3

└─ subprocess\_3\_1

└─ subprocess\_3\_2

└─ subprocess\_3\_3

...

```

Key features of the parent process hierarchy:

1. \*\*Root Process\*\*: All processes in the system start from the root process (PID 1), which is responsible for initialization.

2. \*\*Tree-like Structure\*\*: The process hierarchy has a tree-like structure where each process can have a parent process and may have multiple child processes.

3. \*\*Parent and Child Processes\*\*: Each process has a parent process (except for the root process) and can have one or more child processes.

4. \*\*System Management\*\*: The parent process hierarchy allows system administrators or the operating system kernel to manage and control the execution of processes in the system.

Using the `pstree` command, you can easily visualize this structure and understand how processes interact with each other in your Linux system.

**4. Чим відрізняється команда top від ps?**

The `top` command and the `ps` command are two different commands for viewing information about processes in a Linux system. The main differences between them lie in how they display information and how a user can interact with them.

1. Output Format:

- `top` displays information in real-time and shows a live, updating list of processes. You can see information about CPU usage, memory usage, and other parameters in real-time.

- `ps` outputs information in a static format and shows a list of processes at the time the command is executed. You can customize the output format and select specific fields to display.

2. Interaction:

- In `top`, you can interact with processes while viewing information. For example, you can terminate a process or change a process's priority by pressing the corresponding key.

- `ps` only displays information about processes and does not provide the ability to interact with them directly.

3. Refreshing:

- `top` automatically refreshes the information every few seconds, allowing you to monitor changes in real-time.

- For `ps`, you need to manually execute the command again to refresh the information.

The choice between `top` and `ps` depends on your needs. If you need to track processes in real-time and interact with them, then `top` may be the better choice. However, if you need to get a one-time snapshot of process information at a specific moment, then `ps` may be more useful.

**5. Які додаткові можливості реалізує htop в порівнянні з top?**

`htop` is an interactive command-line utility for monitoring processes in a Linux system, and it provides some additional features compared to the classic `top` command. Here are several key differences and additional capabilities of `htop`:

1. Interactive Interface:

- `htop` has a text-based interface with graphical elements that make it easier to grasp information about processes.

- You can use arrow keys and function keys to interact with the list of processes.

2. Colorful Display:

- `htop` uses color coding to display various aspects of processes, such as CPU usage, memory usage, priority, and more.

3. Sorting:

- You can easily sort the list of processes in `htop` by various criteria, such as CPU usage, memory usage, running time, and so on. Simply press the corresponding sorting key.

4. Stopping and Starting Processes:

- In `htop`, you can stop and start processes directly from the interface without exiting it.

5. Other Interactive Options:

- `htop` provides several other interactive options, such as the ability to view the process tree, switch between different types of information display, filter processes by specific criteria, and more.

Overall, `htop` is a more modern and interactive tool for monitoring processes compared to `top`, and it offers more capabilities for conveniently inspecting and managing processes in a Linux system.

**6. Опишіть компоненти вашої мобільної ОС для здійснення моніторингу запущених в системі процесів?**

A mobile operating system (MOS) has various components that allow monitoring and management of running processes. The key components used for this purpose include:

1. \*\*Operating System Kernel:\*\* The MOS kernel is responsible for managing device resources and performs various tasks related to process monitoring and management. This includes creating, launching, suspending, resuming, and terminating processes.

2. \*\*Task Manager:\*\* This is software that provides users with the ability to view and interact with running processes. Task managers typically allow displaying lists of active processes, their properties (e.g., CPU and memory usage), and the ability to suspend, terminate, or restart processes.

3. \*\*Resource Monitor:\*\* This component allows you to monitor the utilization of device resources such as CPU, memory, network, and more. You can check which processes are consuming the most resources and take actions to optimize resource usage.

4. \*\*Process APIs:\*\* The mobile OS provides APIs for interacting with processes. Developers can use these APIs to create, manage, and monitor processes within their applications. This enables the creation of apps for monitoring and managing processes at the application level.

5. \*\*User Interface (UI):\*\* The OS provides a user interface for displaying information about processes and offering process management capabilities. This interface may be built into a system application or may be part of a third-party app that provides process monitoring and management functionality.

In summary, these components together create the infrastructure for monitoring and managing running processes in a mobile operating system, allowing users and developers to interact with processes on devices running Android, iOS, or other mobile operating systems.

**7. Чи підтримує Ваша мобільна ОС термінальне керування роботою процесів, опишіть як саме.**

Yes, many mobile operating systems like Android and iOS support terminal management of processes through a command-line interface or similar tools. Here are a few ways this can be implemented:

1. \*\*Android:\*\*

- \*\*Android Debug Bridge (ADB):\*\* ADB is a command-line interface for interacting with Android devices. You can use ADB to send commands to the device, including operations like starting, pausing, terminating, and other process-related tasks.

- \*\*Android Terminal:\*\* Many Android devices have a built-in terminal where you can execute commands to manage processes. You can use commands like `ps`, `kill`, `top`, and more for monitoring and managing processes.

2. \*\*iOS:\*\*

- \*\*MobileTerminal:\*\* Some iOS users can install the MobileTerminal app, which provides the ability to interact with the operating system through a command-line interface. With this app, you can execute commands to manage processes.

- \*\*SSH:\*\* Another method is to connect to an iOS device using SSH (Secure Shell) and use the command-line interface to control processes.

In both cases, using terminal process management can be useful for administrators, developers, or advanced users who want more control over processes on their mobile devices. However, it's important to be cautious and not delete or suspend processes that may affect the normal operation of the system or applications.

**8. Чи можливо поставити сторонні програмні засоби, що дозволяють організувати управління та моніторинг роботою процесів у Вашому мобільному телефоні. Коротко опишіть їх.**

Yes, you can install third-party apps on your mobile phone that provide tools for managing and monitoring processes. Here are some popular apps for this purpose:

1. \*\*Task Manager / Task Killer Apps:\*\*

- \*Description:\* These apps provide an interface for viewing the list of running processes and the ability to terminate processes to free up device resources.

- \*Examples:\* "Advanced Task Manager," "Greenify," "Tasker" (for process management automation).

2. \*\*Resource Monitors:\*\*

- \*Description:\* Apps of this type allow you to check the usage of device resources such as CPU, RAM, battery, and others, and provide information about the processes that are using them.

- \*Examples:\* "GSam Battery Monitor," "3C Toolbox," "CPU-Z."

3. \*\*File Explorer / Task Manager Combos:\*\*

- \*Description:\* Some file managers like "ES File Explorer" or "Solid Explorer" also have built-in tools for viewing and managing running processes on the device.

4. \*\*Advanced Root Apps:\*\* If your device is rooted (has full access to the operating system), you can install advanced apps that provide greater control over processes and resources.

- \*Examples:\* "Titanium Backup," "System App Remover."

These apps allow users to monitor the behavior of processes and take action, such as terminating excessive processes to conserve resources or setting priorities. However, caution should be exercised when using such apps, as improperly terminating processes can have negative consequences for the performance of your device or certain apps.

**Висновки**

During the course of the laboratory work, we investigated issues related to monitoring and managing processes in operating systems. We explored the theoretical aspects of these issues and gained practical skills in working with commands and settings related to processes.

Throughout the execution of the work, we gained a deeper understanding of processes in operating systems, including how they are created, managed, and how they impact system resources. We also learned to use tools for monitoring and managing processes, such as the `top`, `htop`, `ps` commands, as well as resource and task monitoring applications.

During the execution of the work, certain difficulties arose, particularly in configuring monitoring parameters and interacting with individual processes. However, through research and practical work, we were able to overcome these challenges and gained valuable experience in working with processes in operating systems.

Overall, completing the laboratory work was beneficial for our group as it allowed us to acquire a comprehensive understanding of how processes operate in operating systems and learn how to effectively monitor and manage them. These skills can be valuable for future research and work in the field of information technology.