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1. Introduction

In this log, delving deeper into UNIX commands and utilities, emphasizing text processing, alias management, and history manipulation. Using commands like:

- mkdir: Creates new directories.
- cd: Changes the current directory.
- cat: Concatenates and displays file content.
- grep: Search for patterns within files.
- alias: Creates shortcuts for longer commands.
- unalias: Removes previously defined aliases.
- history: Displays the list of previously executed commands.
- fc: Lists, edits, and re-executes commands from the history.
- rm: Removes files or directories.

By using these commands, the log provides hands-on experience in managing files, working with text data, and optimizing the command-line environment in UNIX. Through these tasks, users gain proficiency in navigating the file system, handling data, and managing their environment, which are all vital skills for effective system administration and day-to-day usage of UNIX-based systems.

(die.net, n.d.) (GNU, n.d.) (bash aliases, 2020) (GNU, n.d.) (die.net, n.d.) (unix, 2022)

2. Objective

To explore advance UNIX utilities and commands, such as:

- Mastering Text Processing with grep:
- Creating and Managing Aliases for Efficiency:
- Leveraging Command History for Workflow Optimization:
- Improving File and Directory Management Skills.
- Understanding System Administration Tools.
- Improving Overall Command-Line Efficiency and Productivity:

3. Required Tools and Concepts

a. Hardware/Software

- Virtualization Software
- UNIX-based operating system
- A terminal Emulator
- Text Editor
- Unix Shell
- nmap
- getent
- wc

b. Key Concepts

- File System Structure
 - o Directories and Files
 - o File Permissions
- Regular Expressions
 - o Pattern Matching with grep
 - o Common regular expressions
- Shell Commands and Utilities
 - o Basic UNIX Commands
 - o Using grep for Searching and Filtering
 - o History and Command Re-execution
 - o Alias Management
- Networking Concepts
 - o IP Configuration
 - o Subnetting
- System Administration Skills
 - o User Management
 - o System Monitoring and Management

4. Tasks and Steps

i. Create the Directory Structure

Commands Used:

```
mkdir -p lab8/{8cat-grep,other}
```

```
vboxuser@Unbuntu:~$ mkdir -p lab8/{8cat-grep,other}
vboxuser@Unbuntu:~$ tree
.
├── Desktop
├── Documents
├── Downloads
├── lab8
│   ├── 8cat-grep
│   └── other
├── Music
├── Pictures
├── Public
├── snap
│   ├── firmware-updater
│   │   ├── 127
│   │   ├── common
│   │   └── current -> 127
│   └── snapd-desktop-integration
│       ├── 178
│       │   ├── Desktop
│       │   ├── Documents
│       │   ├── Downloads
│       │   ├── Music
│       │   ├── Pictures
│       │   ├── Public
│       │   ├── Templates
│       │   └── Videos
│       ├── common
│       └── current -> 178
├── Templates
└── Videos

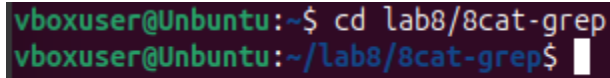
29 directories, 0 files
vboxuser@Unbuntu:~$
```

Figure 1: creating directory

ii. Navigate to the 8cat-grep Directory

Commands Used:

```
cd lab8/8cat-grep
```

A terminal window with a dark background. The prompt is 'vboxuser@Unbuntu:~\$'. The command 'cd lab8/8cat-grep' is entered and executed. The prompt changes to 'vboxuser@Unbuntu:~/lab8/8cat-grep\$' with a cursor at the end.

```
vboxuser@Unbuntu:~$ cd lab8/8cat-grep
vboxuser@Unbuntu:~/lab8/8cat-grep$
```

Figure 2: Navigation to 8cat-grep directory

iii. Create two files Using cat

Commands Used:

```
cat > testa << EOF
```

```
kkkl
```

```
lllm
```

```
oo--oo
```

```
dddkk
```

```
EOF
```

```
cat > testb << EOF
```

```
KKKKK
```

```
LLLLL
```

```
MMMMM
```

```
DDDDD
```

```
EOF
```

```
vboxuser@Unbuntu:~/lab8/8cat-grep$ cat>testa<<EOF
> kkkll
> lllm
> oo--oo
> dddkk
> EOF
vboxuser@Unbuntu:~/lab8/8cat-grep$ cat>testb<<EOF
> KKKKK
> LLLLL
> MMMM
> DDDD
> EOF
vboxuser@Unbuntu:~/lab8/8cat-grep$
```

Figure 3: using cat to create files

iv. Execute the explore grep Commands

Commands Used:

```
grep ll testa
```

```
grep -v ll testa
```

```
grep -n ll testa
```

```
grep -l ll *
```

```
grep -i ll *
```

```
grep -c ll *
```

```
grep '^K' testa testb
```

```
grep -n '^' testa
```

Explanation:

- grep ll testa: Finds lines containing ll in testa.
- grep -v ll testa: Excludes lines with ll.
- grep -n ll testa: Display line numbers with matches.
- grep -l ll *: Lists files containing matches.
- grep -i ll *: Case-insensitive search.
- grep -c ll *: Counts matches per file.
- grep '^K' testa testb: Matches lines starting with k.
- grep -n '^' testa: prints all lines with line numbers.


```
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep ll testa
kkkll
lllm
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -v ll testa
oo--oo
dddkk
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -n ll testa
1:kkkll
2:lllm
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -l ll *
testa
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -i ll *
testa:kkkll
testa:lllm
testb:LLLLL
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -c ll *
testa:2
testb:0
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep '^K' testa testb
testb:KKKKK
vboxuser@Unbuntu:~/lab8/8cat-grep$ grep -n '^' testa
1:kkkll
2:lllm
3:oo--oo
4:dddkk
vboxuser@Unbuntu:~/lab8/8cat-grep$
```

Figure 4: Executing grep commands

v. Define, Use, and Manage Aliases

Commands Used:

```
alias lsal='ls -al'
```

```
alias
```

```
cd ~
```

```
lsal
```

```
vboxuser@Ubuntu:~/lab8/8cat-grep$ alias lsal='ls -al'
vboxuser@Ubuntu:~/lab8/8cat-grep$ alias
alias alert='notify-send --urgency=low -i "${[ $? = 0 ] && echo terminal || echo error}" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[;&|]\s*alert$//'\''
\')"'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -alF'
alias ls='ls --color=auto'
alias lsal='ls -al'
vboxuser@Ubuntu:~/lab8/8cat-grep$ lsal
total 16
drwxrwxr-x 2 vboxuser vboxuser 4096 Dec 28 16:09 .
drwxrwxr-x 4 vboxuser vboxuser 4096 Dec 28 16:06 ..
-rw-rw-r-- 1 vboxuser vboxuser 24 Dec 28 16:09 testa
-rw-rw-r-- 1 vboxuser vboxuser 24 Dec 28 16:09 testb
vboxuser@Ubuntu:~/lab8/8cat-grep$
```

Figure 5: Defining Aliases and using it

```
vboxuser@Ubuntu:~/lab8/8cat-grep$ cd ~
vboxuser@Ubuntu:~$ lsal
total 80
drwxr-x--- 17 vboxuser vboxuser 4096 Dec 28 16:06 .
drwxr-xr-x 3 root root 4096 Dec 28 13:54 ..
-rw-r--r-- 1 vboxuser vboxuser 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 vboxuser vboxuser 3771 Mar 31 2024 .bashrc
drwx----- 9 vboxuser vboxuser 4096 Dec 28 16:03 .cache
drwx----- 11 vboxuser vboxuser 4096 Dec 28 15:45 .config
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Desktop
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Documents
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Downloads
drwx----- 2 vboxuser vboxuser 4096 Dec 28 15:45 .gnupg
drwxrwxr-x 4 vboxuser vboxuser 4096 Dec 28 16:06 lab8
drwx----- 4 vboxuser vboxuser 4096 Dec 28 13:55 .local
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Music
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Pictures
-rw-r--r-- 1 vboxuser vboxuser 807 Mar 31 2024 .profile
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Public
drwx----- 4 vboxuser vboxuser 4096 Dec 28 15:10 snap
drwx----- 2 vboxuser vboxuser 4096 Dec 28 13:54 .ssh
-rw-r--r-- 1 vboxuser vboxuser 0 Dec 28 16:01 .sudo_as_admin_successful
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Templates
drwxr-xr-x 2 vboxuser vboxuser 4096 Dec 28 13:55 Videos
vboxuser@Ubuntu:~$
```

Figure 6: Managing Aliases

vi. Remove the alias, and show the system does not store it

Commands Used:

```
unalias lsal
```

```
alias
```

```
lsal
```

```
vboxuser@Ubuntu:~$ unalias lsal
vboxuser@Ubuntu:~$ alias
alias alert='notify-send --urgency=low -i "${[ $? = 0 ] && echo terminal || echo error}" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[\;:&|]\s*alert$//\''')"'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -alF'
alias ls='ls --color=auto'
vboxuser@Ubuntu:~$ lsal
Command 'lsal' not found, did you mean:
  command 'lsar' from debunar (1.10.7+ds1+really1.10.1-2build3)
Try: sudo apt install <deb name>
vboxuser@Ubuntu:~$
```

Figure 7: Removing the Alias

vii. Define the Alias Again, Preserving it for the Next Session,

Commands Used:

```
echo "alias lsal='ls -al' " >> ~/.bashrc
```

```
source ~/.bashrc
```

```
alias
```

Explanation:

- Adding the alias definition to the ~/.bashrc file so it persists across sessions.
- Reloads the ~/.bashrc file to apply changes immediately without restarting the terminal.
- Lists all currently defined aliases in the shell.
- Tests the alias by executing ls -al through the alias lsal.

```

vboxuser@Ubuntu:~$ echo "alias lsal='ls -al'" >> ~/.bashrc
vboxuser@Ubuntu:~$ source ~/.bashrc
vboxuser@Ubuntu:~$ alias
alias alert='notify-send --urgency=low -i "${([ $? = 0 ]) && echo terminal || echo error}" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[\t;]&|)\s*alert$//'\''
\''\''"'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -alF'
alias ls='ls --color=auto'
alias lsal='ls -al'
vboxuser@Ubuntu:~$ lsal
total 80
drwxr-x--- 17 vboxuser vboxuser 4096 Dec 28 16:06 .
drwxr-xr-x  3 root      root      4096 Dec 28 13:54 ..
-rw-r--r--  1 vboxuser vboxuser   220 Mar 31  2024 .bash_logout
-rw-r--r--  1 vboxuser vboxuser  3791 Dec 28 16:23 .bashrc
drwx-----  9 vboxuser vboxuser  4096 Dec 28 16:03 .cache
drwx----- 11 vboxuser vboxuser  4096 Dec 28 15:45 .config
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Desktop
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Documents
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Downloads
drwx-----  2 vboxuser vboxuser  4096 Dec 28 15:45 .gnupg
drwxrwxr-x  4 vboxuser vboxuser  4096 Dec 28 16:06 lab0
drwx-----  4 vboxuser vboxuser  4096 Dec 28 13:55 .local
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Music
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Pictures
-rw-r--r--  1 vboxuser vboxuser   807 Mar 31  2024 .profile
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Public
drwx-----  4 vboxuser vboxuser  4096 Dec 28 15:10 snap
drwx-----  2 vboxuser vboxuser  4096 Dec 28 13:54 .ssh
-rw-r--r--  1 vboxuser vboxuser     0 Dec 28 16:01 .sudo_as_admin_successful
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Templates
drwxr-xr-x  2 vboxuser vboxuser  4096 Dec 28 13:55 Videos
vboxuser@Ubuntu:~$ █

```

Figure 8: Redefining Alias again

viii. Define nwho alias for the number of system file

Commands Used:

```
alias nwho='getent passwd | wc -1'
```

```
nwho
```

Explanation:

- getent passwd : Retrieves entries from the system's password database, which includes user account information.
- wc -1 : Counts the number of lines output by the getent passwd command, efficiently counting the number of users on the system.

```
vboxuser@Ubuntu:~$ alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$ which getent
/usr/bin/getent
vboxuser@Ubuntu:~$ alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$ alias
alias alert='notify-send --urgency=low -i "${[ $? = 0 ]} && echo terminal || echo error" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/;;s/;/&|'\`)\s*alert$//'\`)"'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -alF'
alias ls='ls --color=auto'
alias lsa='ls -al'
alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$ nwho
wc: invalid option -- '1'
Try 'wc --help' for more information.
vboxuser@Ubuntu:~$ alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$ Ubuntu
Ubuntu: command not found
vboxuser@Ubuntu:~$ alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$ nwho
wc: invalid option -- '1'
Try 'wc --help' for more information.
```

Figure 9: Defining nwho alias

ix. List last Executed Commands

Command used:

history

```
vboxuser@Unbuntu:~$ history
 1  tree
 2  sudo apt update
 3  sudo apt install tree
 4  tree --version
 5  tree
 6  mkdir -p lab8/{8cat-grep,other}
 7  tree
 8  cd lab8/8cat-grep
 9  cat>testa<<EOF
10  kkkll
11  lllm
12  oo--oo
13  dddkk
14  EOF
15  cat>testb<<EOF
16  KKKKK
17  LLLLL
18  MMMMM
19  DDDDD
20  EOF
21  grep ll testa
22  grep -v ll testa
23  grep -n ll testa
24  grep -l ll *
25  grep -i ll *
26  grep -c ll *
27  grep '^K' testa testb
28  grep -n '^' testa
29  alias lsal='ls -al'
30  alias
31  lsal
32  cd ~
33  lsal
```

Figure 10: History 1-32

```
34 unalias lsal
35 alias
36 lsal
37 echo "alias lsal='ls -al'" >> ~/.bashrc
38 source ~/.bashrc
39 alias
40 lsal
41 alias nwho='getent passwd | wc -1'
42 nwho
43 alias nwho='getent passwd | wc -1'
44 nwho
45 wc --help
46 health fc
47 health wc
48 ping google.com
49 static ip
50 ip info
51 ip config
52 sudo ip addr add NEW_IP/24 dev INTERFACE_NAME
53 sudo ip addr add 192.168.1.100/24 dev enp3s0
54 ip addr show
55 sudo netplan apply
56 sudo apt install coreutils
57 which wc
58 ip addr
59 ip addr show
60 ls /etc/netplan/
61 sudo nano /etc/netplan/50-cloud-init.yaml
62 sudo ifconfig enp3s0 192.168.1.100 netmask 255.255.255.0 up
63 sudo ip addr add 192.168.1.100/24 dev enp3s0
64 ip addr show
65 sudo apt update
66 sudo apt install net-tools
67 ifconfig
68 ip addr show
69 sudo ip addr add 192.168.1.100/24 dev enp0s3
```

Figure 11: history 33-69

```
70 sudo ip route add default via 192.168.1.1
71 if config; ifconfig
72 ifconfig
73 ping google.com
74 cat /etc/resolv.conf
75 nameserver 8.8.8.8
76 sudo nano /etc/resolv.conf
77 ping 192.168.1.1
78 ping google.com
79 sudo systemctl restart NetworkManager
80 which systemctl
81 sudo apt update
82 sudo apt install network-manager
83 sudo apt install network-manager
84 which systemctl
85 dpkg -1 | grep network-manager
86 sudo systemctl restart NetworkManager
87 sudo apt install systemd
88 sudo service network-manager restart
89 dpkg -1 | grep network-manager
90 exit
91 sudo apt install nmap
92 nmap -sn 192.168.1.0/24
93 sudo netplan apply
94 sudo nano /etc/netplan/01-netcfg.yaml
95 arp-scan
96 sudo apt install arp-scan
97 sudo arp-scan --interface=eth0 --localnet
```

Figure 12: History 70 to 97

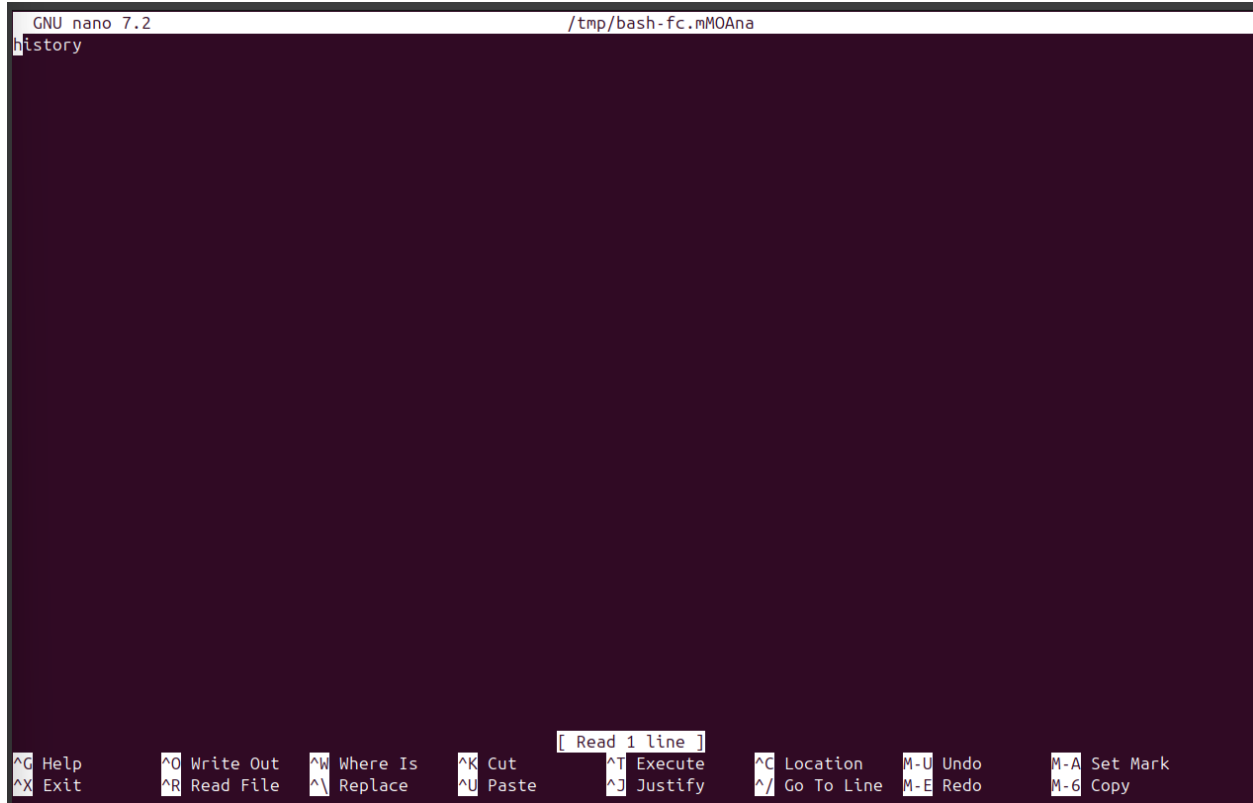

```
86  sudo systemctl restart NetworkManager
87  sudo apt install systemd
88  sudo service network-manager restart
89  dpkg -1 | grep network-manager
90  exit
91  sudo apt install nmap
92  nmap -sn 192.168.1.0/24
93  sudo netplan apply
94  sudo nano /etc/netplan/01-netcfg.yaml
95  arp-scan
96  sudo apt install arp-scan
97  sudo arp-scan --interface=eth0 --localnet
98  ping 192.168.1.150
99  192.168.1.x
100 ping 192.168.1.x
101 ping google.com
102 sudo apt update
103 sudo apt install libc-bin
104 alias nwho='getnet passwd | wc -1'
105 nwho
106 getnet passwd | wc -1
107 sudo apt install getent
108 sudo apt getinstall getent
109 .bashrc
110 sudo apt install libc-bin
111 alias nwho='getent passwd | WC -1'
112 which getent
113 alias nwho='getent passwd | wc -1'
114 alias
115 nwho
116 alias nwho='getent passwd | wc -1'
117 Ubuntu
118 alias nwho='getent passwd | wc -1'
119 nwho
120 history
```

Figure 13: History 98 to 120

x. Re-Execute the Last but One Command Using r

Command used:

`fc -r`



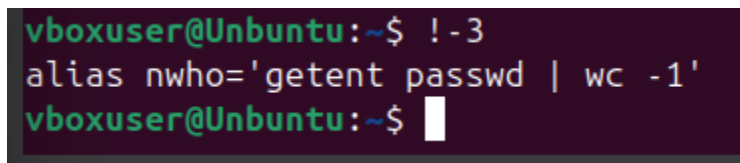
The screenshot shows the GNU nano 7.2 editor interface. The top status bar displays 'GNU nano 7.2' and the file path '/tmp/bash-fc.mMOAna'. The main editing area is dark purple and contains the word 'history' on the first line. The bottom status bar shows various keyboard shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^U Undo, ^M-A Set Mark, ^X Exit, ^R Read File, ^_ Replace, ^U Paste, ^J Justify, ^_/ Go To Line, ^M-E Redo, and ^M-6 Copy. A small tooltip '[Read 1 line]' is visible above the 'Execute' shortcut.

Figure 14: Re-Executing the last but one command using r

xi. Re-Execute the Command Given Three Commands Ago

Command used:

`!-3`



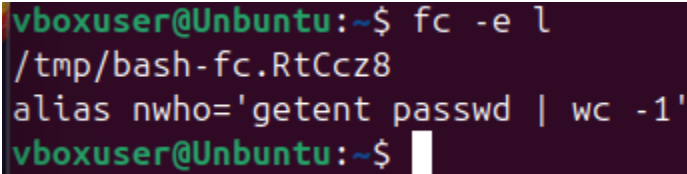
The screenshot shows a terminal window with the prompt 'vboxuser@Unbuntu:~\$'. The command '!-3' has been entered, and the prompt has moved to the next line. The command 'alias nwho='getent passwd | wc -1'' is visible on the line below the prompt.

Figure 15: Re-Execute the command given three commands ago

xii. Re-Execute the Last Command That Begins with l

Command used:

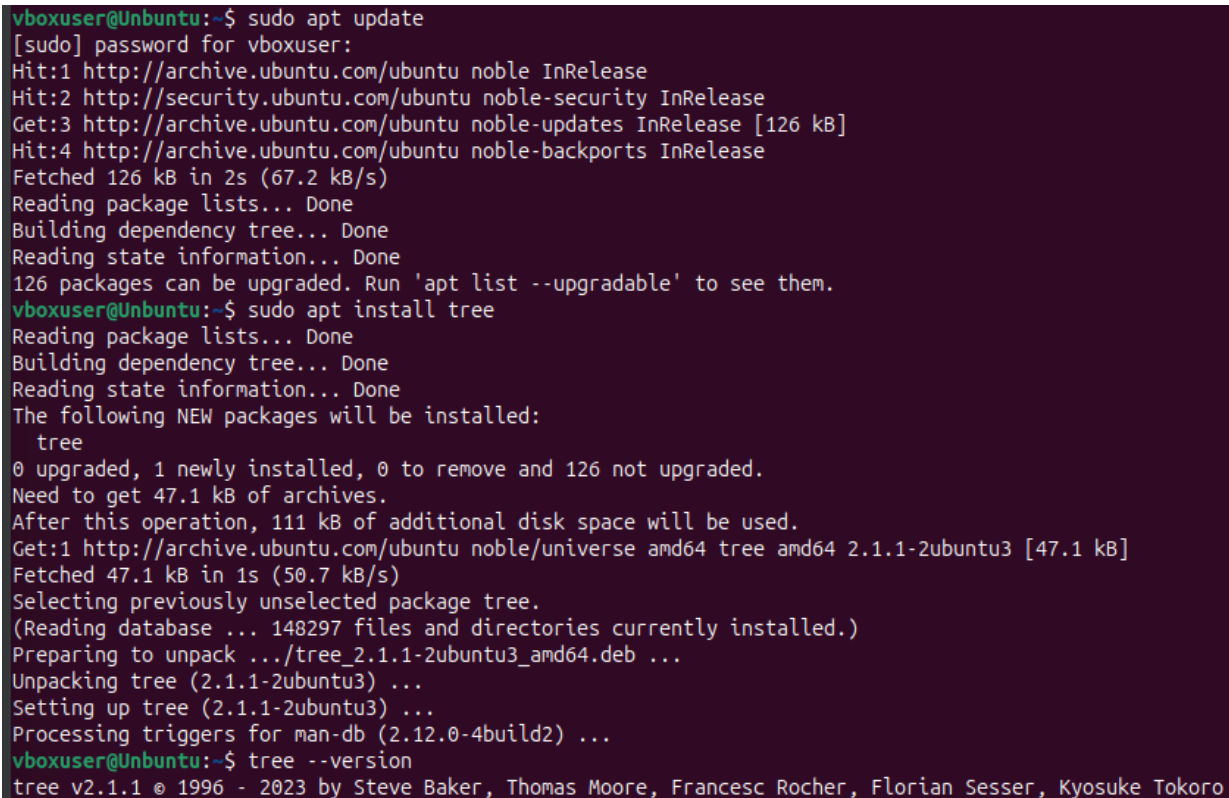
```
fc -e l
```



```
vboxuser@Ubuntu:~$ fc -e l
/tmp/bash-fc.RtCcZ8
alias nwho='getent passwd | wc -1'
vboxuser@Ubuntu:~$
```

Figure 16: Re-Execute the last command that begins with l

Others



```
vboxuser@Ubuntu:~$ sudo apt update
[sudo] password for vboxuser:
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Fetched 126 kB in 2s (67.2 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
126 packages can be upgraded. Run 'apt list --upgradable' to see them.
vboxuser@Ubuntu:~$ sudo apt install tree
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 126 not upgraded.
Need to get 47.1 kB of archives.
After this operation, 111 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 tree amd64 2.1.1-2ubuntu3 [47.1 kB]
Fetched 47.1 kB in 1s (50.7 kB/s)
Selecting previously unselected package tree.
(Reading database ... 148297 files and directories currently installed.)
Preparing to unpack ../tree_2.1.1-2ubuntu3_amd64.deb ...
Unpacking tree (2.1.1-2ubuntu3) ...
Setting up tree (2.1.1-2ubuntu3) ...
Processing triggers for man-db (2.12.0-4build2) ...
vboxuser@Ubuntu:~$ tree --version
tree v2.1.1 © 1996 - 2023 by Steve Baker, Thomas Moore, Francesc Rocher, Florian Sesser, Kyosuke Tokoro
```

Figure 17: Updating and Installing tree

Cancel

Wired

Apply

DetailsIdentityIPv4IPv6Security

IPv4 Method

☐ Automatic (DHCP)

☐ Link-Local Only

☒ Manual

☐ Disable

☐ Shared to other computers

Addresses

| Address | Netmask | Gateway | |
|---------------|---------------|-------------|--|
| 192.168.1.150 | 255.255.255.0 | 192.168.1.1 | |
| | | | |

DNS

Automatic

Separate IP addresses with commas

Routes

Automatic

| Address | Netmask | Gateway | Metric | |
|---------|---------|---------|--------|--|
| | | | | |

☐ Use this connection only for resources on its network

Figure 18: Static IP configuration

5. Conclusion

In this lab, various advanced UNIX utilities and commands were explored to enhance system navigation and efficiency.

- i. Creation of directory structures and managed files using `mkdir` and `cat`.
- ii. Explored `grep` for efficient text searching and pattern matching.
- iii. Defined, managed, and preserved aliases, such as `Lsal` for `ls -al`, to improve command-line efficiency.
- iv. Leveraged command history to re-execute commands, to enhance workflow effectively.

These activities underscored UNIX's capabilities in automating tasks and processing text data, providing a robust foundation for system administration.

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