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Introduction to Linux

Bell Labs withdrew from the project, Its members developed an OS UNIX - by themselves

UNIX was originally free and later implemented TCP/IP protocol stack which became first choice for early workstation OS.

In 1990, UNIX became the mainttream OS in server market. Unix eventually become commericalized and very expensive. Substitute was MINIX.

Linus Torvalds (the father of Linux)
Wanted to run similar OS, but commercial version was expensive. Started with MINIX. First release of his OS attarcked hackers. It was named Linux. He advanced it with attractive features.

Linux is just a kernel of the operating system, which is the basis for other programs to run.

Programs such as command line interpreters (shell) are some programs running on top of th ekernal. These apps are not develoiped as part of linux. They are free apps shipped along with linux for installation.

In 1984, Richard Stallman started the GNU (GNU's Not Unix) project and founded the FSF (Free Software Foundation);

In 1985, in order to protect free software produced by GNU from being patented by others, GPL (General Public License) was created;

Ken Thompson : the father of C language and UNIX
Dennis Ritchie : the father of C language and UNIX
Stallman : famous hacker, GNU founder, developed Emacs, gcc and Bash (shell)
Bill Joy: BSD developer
Tanenbaum: Minix developer
Linus Torvalds : the father of Linux

UNI/XLinux has no graphical interface. The GUI we see in distros of UNIX/.LINUX is running on a linux system stoftare.

Xorg is a server that provides graphical interface services, just like Apache that provides web services.

In essence, the terminal is corresponding to the /dev/tty device on Linux

It is a program that accepts user input commands. It is called "shell" because it hides details of the underlying operating system.

Shell of UNIX/Linux operating system is not only the user interaction interface but also a scripting language which can control system.

In Linux, the most important thing is a command, which contains three streams (data channels): input, output and error.

Shortcut Key	Function
`Ctrl + d`	Keyboard input ends or exits the terminal
`Ctrl + s`	Pause the current program and press any key to resume it
`Ctrl + z`	Put the current program into the background
`Ctrl + a`	Move the cursor to the beginning of the input line, equivalent to `Home`
`Ctrl + e`	Move the cursor to the end of the input line, equivalent to `End`
`Ctrl + k`	Remove content from the the place the cursor is currently at to the end of the line
`Alt + Backspace`	Delete a word forward
`Shift + PgUp`	Scroll up the terminal
`Shift + PgDn`	Scroll down the terminal

character	meaning
`*`	Match any zero or more characters
`?`	Match any single character
`[list]`	Match any single character of the list
`[!list]`	Match characters other than any single character of list
`[c1-c2]`	Match any single character in the range c1 to c2 such as [0-9], [a-z]
`{string1,string2,...}`	Match string1 or string2 (or more) with a string
`{c1..c2}`	Match all characters or numbers in the range c1 to c2 such as {1..10}

Section	Description
1	General order
2	System call
3	Library functions, covering the C standard library
4	Special files (usually devices in /dev) and drivers
5	File format and convention
6	Games and screensavers
7	Others
8	System management commands and daemons

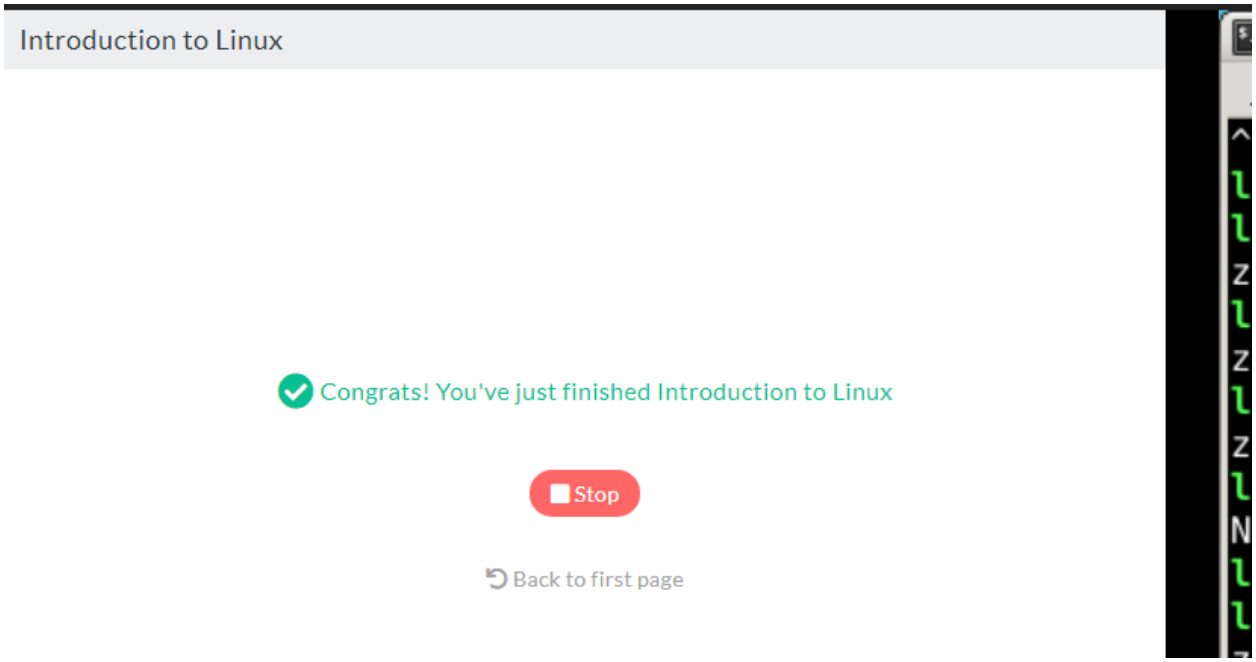
To view the contents of a particular section, simply add the number of corresponding section after the man:

```
$ man 1 ls
```

$ sudo apt-get update
$ sudo apt-get install sysvbanner
$ banner labex

$ printerbanner -w 50 A
-w specifices the print width

Two similar commands toilet and figlet are your homework.



Lab 2 - Linux User/ Group and File Permission

who am i
First colum outputs the username of the user who opened the current terminal.

whoami shows current user name of logged in user.

Pts represents the spedu terminal.(can be switched to different terminal #)

Parameters of `who`:

Parameter	Description
`-a`	Print all information
`-d`	Print dead process
`-m`	Same as `am i`, `mom likes`
`-q`	Get number of users logged in and their user names
`-u`	Get the list of users logged in
`-r`	Get the current run level

Root is super admin. Supreme power of the system.
Sudo gives root privileges.

su <a> switches to user a
su - <user> switch users

sudo adduser jack #to create a new user
sudo adduser jackass -aG bishajitgroup

su -l jack ; to switch to that user

A user group is a collection of users who share some resources and permissions, and have private resources.

group labex

Cat /etc/group | sort
Cat command is used to read the contents of the specified file and print it out.
| sort - means that the text is sorted and output by dictionary sort.

Filter out some of the results you don't want to see
Cat /etc/group | grep -E “labex”
Grep searches for a string that you specify

/etc/group has user groups, user group passwords, GIDs and users in the groups.
User group record is located : group_name:password:GID:user_list
Su -l jack
Sudo ls

Usermod is used to add a user to a user group

Sudo groups jack
Sudo usermod -G sudo jack
Sudo groups jack

To delete a user
Sudo deluser jack --remove-home

To view file permissions 3.1
Ls -l to list files in long format
Cat <filename> to read the contents of a file
W- You can edit and modify a file
X- execute.

Number of links - the number of files linked to the inode.

File size - ls -lh

Ls -a to display all files except the .(current directory) and ..(parent directory)
Ls -al
Ls -dl <directory> to view full properties of a directory

Ls -AsSH to show all the file sizes. ‘s’ is used for the display file size. ‘S’ is used for sorting file by file size.

Chmod 700 iphonex

Chmod go-rw iphonex
U, g, and o represent user(file owner), group and others
- + And - represent to add and remvoe the corresponding permissions

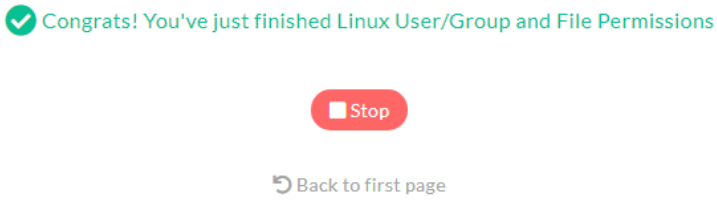
Useradd only creates the user
We need to use passwd to setup a password for the new user

Adduser not only creates a user, but creates a directory and a password

Homework create a user named labextester
Create a new file /opt/forlabex
Grant the user labextest permissions to write and read the file.

Sudo adduser labextest
Cd /opt/
Ls
Sudo touch forlabex
Sudo Chmod 666

Linux User/Group and File Permissions



Challenge 1

We need to create two new employees joining Labex.

1. Username : jack
2. Home directory : /home/jack
3. User jack uses zsh by default.
4. User jack belongs to `labex` user group as well as `dev` user group.

1. Username : bob
2. Home directory : /home/bob
3. User bob uses bash by default.
4. User bob belongs to `labex` user group as well as `test` user group

sudo adduser jack

cd /home/jack

From looking at the problem it looks like each user needs to be assigned to a different shell (terminal). Jack needs to be assigned to zsh and bob needs to be assigned to bash.

To check if the user is zsh is by using

vi /etc/paswd

You can also use this command to specifically filter out the rest of responses and showing only one

cat /etc/passwd | grep -E “labex”

If a user does not have the correct shell you can re-assign it by using these commands… (https://www.tecmint.com/change-a-users-default-shell-in-linux/)

Check what shells are available using

cat /etc/shells

1) CHSH Utility
    - **grep jack /etc/passwd**
    - **chsh --shell /bin/zsh jack**
    - **grep jack /etc/passwd**
2) Changing user shell using VI editor (but you need write permissions)
    - **vi /etc/passwd**

To see what user groups Jack belongs to, use the following…

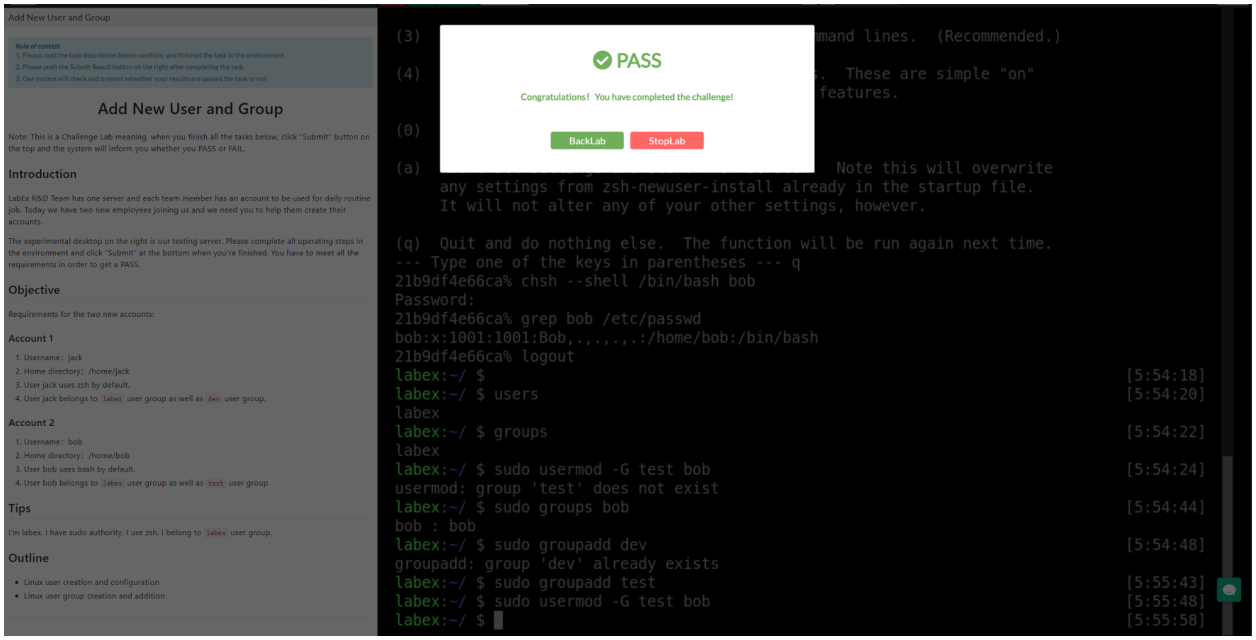
sudo groups jack

To create a user group, use the following

sudo groupadd dev

To add a user to a created group, use the following

sudo usermod -G dev jack



Lab #3 Files and Directory

Windows uses disk symbols (C drive, D drive) to achieve file management. Other files can be also stored in any directory. Overall gets messy after a while

Unix is directory based. Everything is stored on disk. Linux has a tree-like directory structure to build the entire system. Linux

Directory structure in Linux is FHS standard. File Hierarchy standard. FHS defines the use of every area in the system, the minimal set of required files and directories and also provides exception handling and contradicting handling

1. The various directories below `/` should contain specific files, such as setting files should be placed in the directory `/etc` and executable files should be placed in `/bin`, `/sbin`.
2. There are explicit definitions of the subdirectories of the two directories `/usr` and `/var`, such as`/var/log` to place the system log files and `/usr/share` to place shared data.

tree / ; shows entire directory structure

Absolute Path

The absolute path contains the root directory and all other subdirectories in which a file or directory is contained. For example: `/usr/local/bin` indicates the 'bin' directory in the 'local' directory in the 'usr' directory of the root ('/') directory.

Relative Path

Relative path is defined as a path relative to the present working directory (pwd). Suppose I am located in `/var/log` and I want to change directory to `/var/log/kernel`, I can use relative path concept to change directory to `kernel`.

Using `mkdir` with the -p parameter can create the parent directory if the parent directory does not exist. We create multi-level directories (this is useful when installing software and configuring installation paths

You can copy to a specific file directory

Cp test father/son/daughter

rm -f ; to force delete

rm -r to del,ete recursively

Mv file1 <path>

Mv file1 <newname>

Rename command is used to rename multiple files

Cat prints the contents in forward order

Tac prints the contents in reverse order

Standard input, output and error: When we execute a shell command, the system will automatically open three standard files: the standard input file (stdin), the standard output file (stdout) and the standard error output file (stderr). The process will get input data from the standard input file and output the data to the standard output file. If there is any error, the process will send the error message to the standard error file.

Cat -n passwd (-n displays the line number)

-n 1 selects one line

More can only roll in one direction

Less allows backward movement in a file along with forward.

Head and Tail to view a file

Head displays the first count lines/bytes of each of the specific files.

Tail displays the last count line of files.

File command basically shows the file type.

Emacs, vim, nano, vimtutor

To show an eyes effect on terminal

Xeyes

Nohup xeyes &

Homework

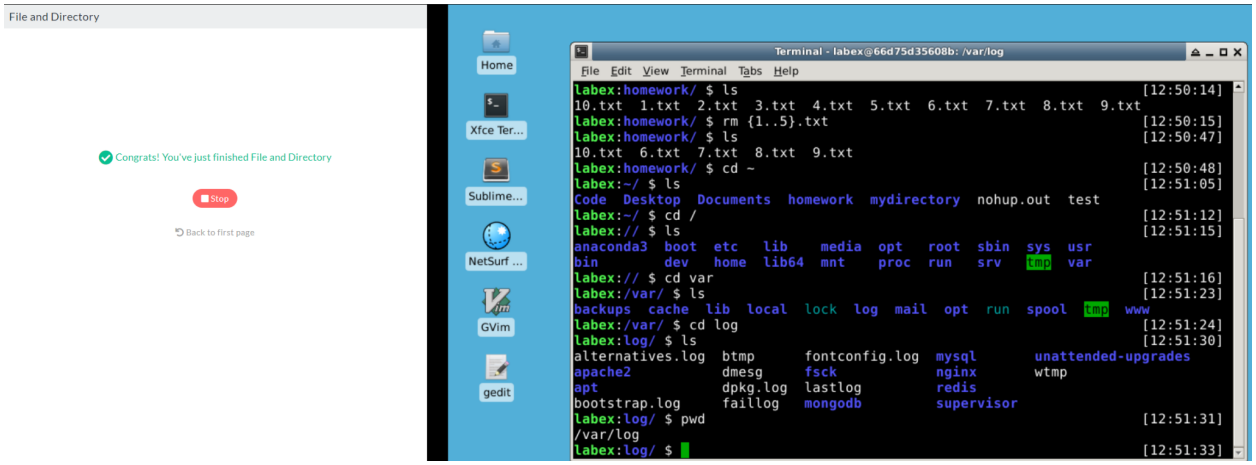
1. Create a directory, named homework.
2. In the directory homework, create files named 1.txt to 10.txt.
3. Delete the files with names in the range 1.txt to 5.txt.
4. Where are the log files for Linux saved?

mkdir homework

touch {1..10}.txt

rm {1..5}.txt

/var/log



Lab #4 Environment Variable and Find Files

Variable is a symbol used in a computer to record a value. Are used in different operations.

Declare command is used to create a variable

= is used to assign a variable to a value

Echo $tmp

We will use three variable types:

- Private custom variables of current shell process, such as `tmp` we've created above which is only valid in the current shell;
- Built-in variable of shell;
- Environment variables derived from custom variables.

set , env, export are 3 commands related. They used to print environment variable info.

Set display all the variables of the current shell, including built in environm,ent variables, user-defined vars, and exported neivornment vars

Env display environment vars associated with the current user and allows the command to run in specified environment

Export displays vars that are exported from the shell as environment vars and it can also export custom vars as environment variables

Vimdiff used to compare difference

Sort is used to sort

PATH saves the search parths of commands

Echo $PATH

Executable shell scriptGedit hello_shell.sh

Chmod 755 to give executable permission

./hello_shell.sh to run it

Creating hello world .c

Gcc hello_world.c -o hello_world ; to make it an executable file

>> indicates the standard output is redirected to a file.

Setting method	**Description**

`${name#match string}`	From front to back, delete the shortest string that matches the string
`${name##match string}`	From front to back, delete the longest string that matches the string
`${name%match string}`	From back to front, delete the shortest string that matches the string
`${name%%match string}`	From back to front, delete the longest string that matches the string
`${nameold stringnew string}`	Replace the first string that matches the old string with the new string
`${nameold stringnew string}`	Replace all strings that match the old string with the new string

Unset temp is used to unset to delete an environment var

Source command lets us make things work immediately without reopening terminal

. is an alias for source

. .zshrc

Whereis who is used to search for files

Locate

Finds files through a database. System will update once a day. Manually update using updatedb.

Locate etch

Locate usrshare.jpg

-c is used to count the number of files. -i is used to search ignoring cases

Which is a command. Determines weather to install a software package because it only searches from PATH environ,ent to search for a command.

Find is most powerful. It can also search for files becased on file type, name, file based on file attributes.

`-atime`	Last visit time (Last access time)
`-ctime`	The last time when the contents of the file were modified
`-mtime`	The last time when the file attributes were modified

Cmatrix effect command

Sudo apt-get update

Sudo apt-get install cmatrix

Cmatrix

Homework

Find all the files with suffixes `.conf` in `etc`.

Cd /etc

Find *.conf

Challenge 2 - Find a file

There is a very important document (sources.list) in your computer, but you don't remember its location. The only thing you vaguely remember is that it's in the `/etc/` directory. Now you want to find this file, and set access authority so that you're the only authorized user to access this file.

1. Find the file (sources.list).
2. Change the file owner to yourself (`labex` user).
3. Set access authority so that only you can write/read this file.

Cd /etc

Find ./*/sources.list

./apt/sources.list

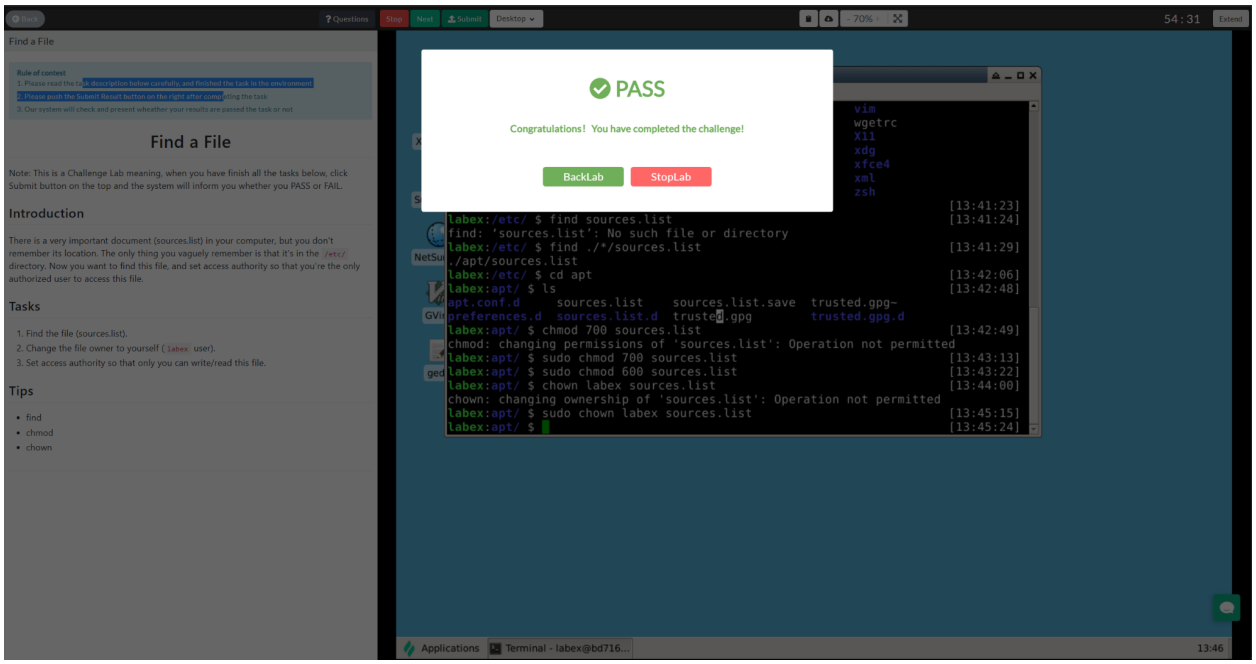
Cd apt

To change the file owner, utilzie chown

sudo chown labex source.list

To give write and read access but no execute

Sudo chmod 600 sources.list



Lab #5 - File packing and compression

Different file format compression extensions

Zip to compress and package programs

Unzip to decompress a zip file

zip -r -q -o labex.zip /home/labex/lib

-r parameter indicates that the recursive package contains the entire contents of the subdirectory

-q quiet mode meaning no messages are output to screen.

-o means that the output file is required

du -h labex.zip

Du is used to view the size of the compressed file

-h --human-readable

D --max-depth

Compression level to 9 and 1. (9 max, 1 minimum)

zip -r -9 -q -o labex_9.zip /home/labex/lib -x ~/*.zip

1 means the fastest compression but bulky.

9 stands for the smallest size but takes the longest time.

-x is to avoid the previous package-generated zip file being packaged into this current zip file.

Only absolute path.

Zip -e is used to encrypt an file

add -l parameter to convert LF to CR+LF. For compatibility issues between windows and linux

Unzip labex.zip

-q quiet mode

-d to extract to a directory using specified name and -d

-l is used to see the contents of the zip without extractinmg it.

-O GBK to specify encoding type

Rar

Sudo apt-get update

Sudo apt-get instaall rar unrar

rar a labex.rar /home/labex/lib

The above command uses the a parameter to add a directory /home/labex/lib to an archive.

To remove a file from an archive

Rar d labex.rar .zshrc

Unrar to extract

unrar e is used to extract to a specified path

Create a tar archive

tar -cf labex.tar home/labex/lib

-c means the creation of a tar archive

-f used top specify a file name

Tar -xf labex.tar -C tardir

Extracting a tar archive

-x is used to extract to the current directory.

-C is used with -x to extract to a specified path

$ sudo apt-get install libaa-bin

$ aafire

Mimics the shape of a flame

Homework

Create a file named test

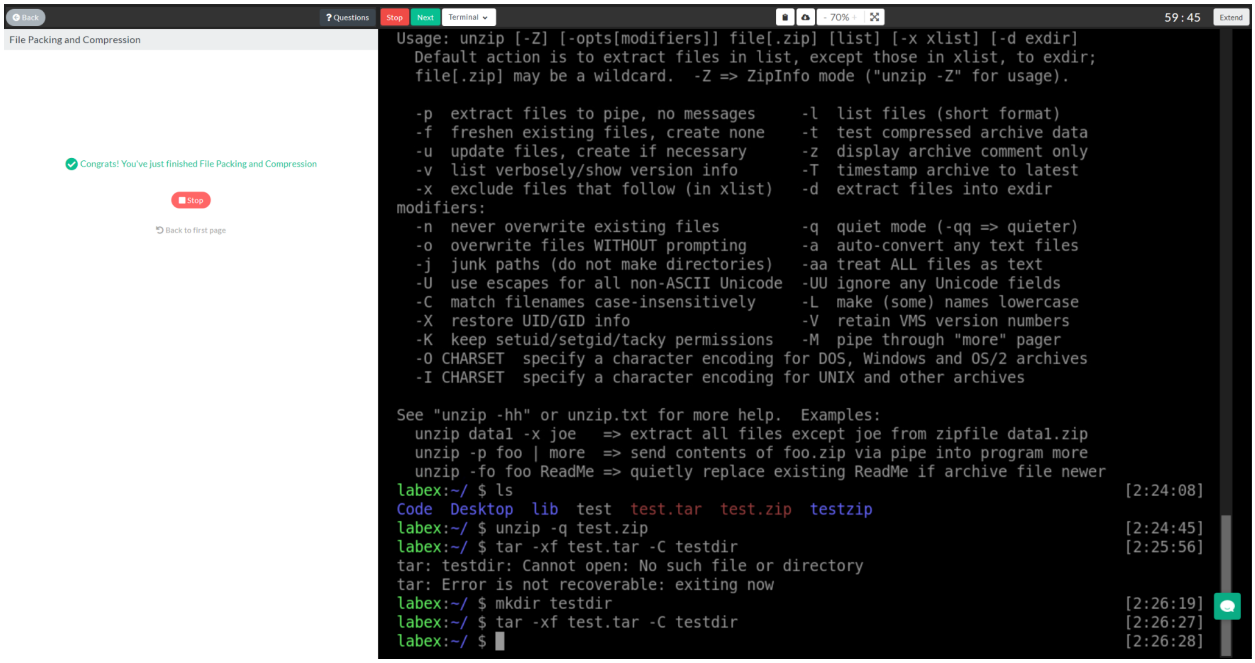
Then use zip and tar to package and compress it . Last you need to extract the archive to /home/labex

zip -q -o test.zip /home/labex/test

Unzip -q test.zip

tar -cf test.tar ./test

tar -xf test.tar -C testdir



Lab #6

Filesystem and Disk Management

Df to view the capacity of the disk

Du is used to view the contents of a directory

Rootfs (root file system)

rootfs" (Root File System) is a particular instance of Ramfs (Ramfs is a very simple Linux file system used to implement a disk cache mechanism as a dynamically resizable file system) or tmpfs (a temporary file system). Normally, the host will replace it with the file system on the disk after the system starts. But some embedded systems will only have rootfs, or the virtual environments to share the host resources may also use rootfs.

/dev/sda2 is the disk partition. Last number represents to the partition num,ber

df -h to see human readable

Du - use blocks to show the size of a directory

-d # specifies the depth of directories # can be changed level in directory

Du -h #--human-readable using k,m, g, as a unit to rimpveo readability

Du -a #--all displaying size of all the files int he directory

Du -s #--summarize only shows the total value

Dd command is used to convert and copy files. Different from cp. DD can read and write all files on linux. Dd can also be used to backup hardware boot sector. The dd command is different from other linux command because its command line option format is option=value. You can change standard input and written input using if(input file) and of(output file)

Sends output to a file

$ dd of=test bs=10 count=1 # or dd if=/dev/stdin of=test bs=10 count=1

Sneds output to stdout (standard output stream)

$ dd if=/dev/stdin of=/dev/stdout bs=10 count=1

Re

Dd can be used to data conversion

Dd if=/dev/stdin of=test bs=10 count=1 conv=ucase

Ddcma ne ised tp create a virtual image file

dd if=/dev/zero of=virtual.img bs=1M count 256

du -h virtual.img

Mkfs to format the disk

Sudo mkfs.ext4 virtual.img

Mount command to mount the disk to the directory tree

You can mount a file containing the file system to the directory

mount [options] [source] [directory]

mount [-o [options]] [-t external type] [-w|--rw|--ro] [File system source] [mount point]

Sudo unmount /mnt to unmount a disk

Fdisk is used to partition a disk

Sudo fdisk virtual.img - to change to disk partition mode

Losetup establish an association between loopback devices and the image file

Before formatting we have to create a virtual device for the partition mapping

sudo apt-get install kpartx

```
# Mount the disk partition
$ sudo mount /dev/mapper/loop0p1 /media/virtualdisk_1
$ sudo mount /dev/mapper/loop0p5 /media/virtualdisk_2
$ sudo mount /dev/mapper/loop0p6 /media/virtualdisk_3
```

Instlal cowsay

Sudo apt-get install cowsay

Cowsay hello Labex

Cowsway -1

Cowsay -f elephant hello labex

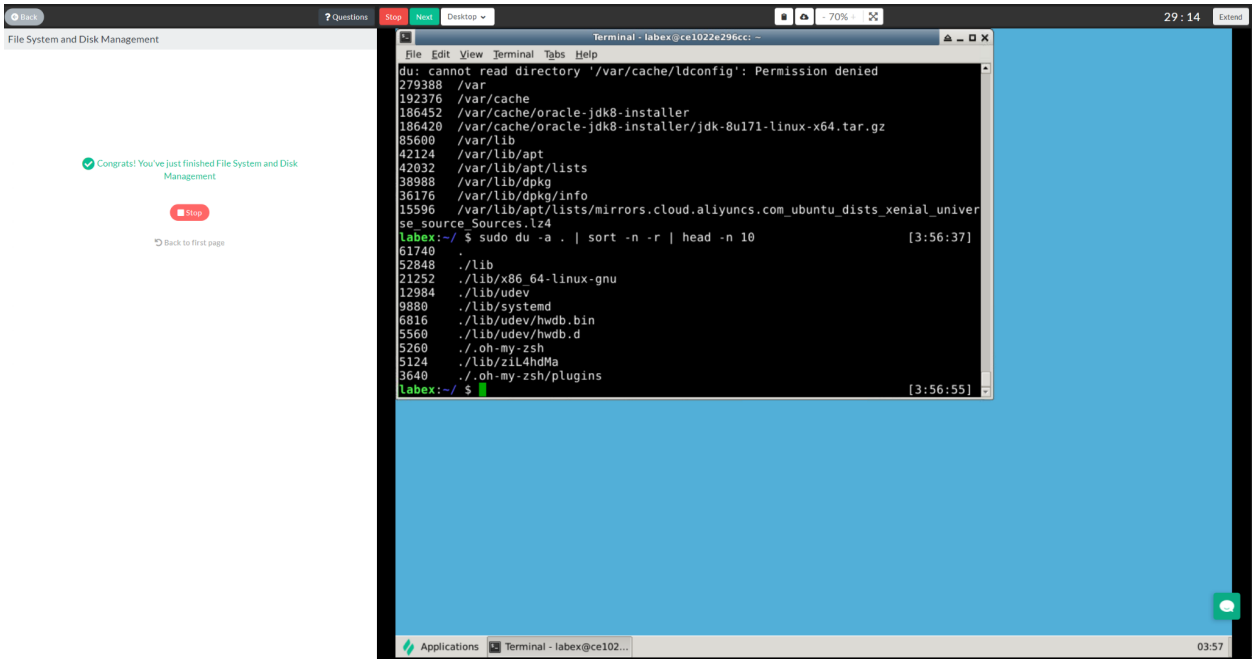
Fortune | cowsay -f daemon

Homework

Find the top 10 files that occupy the largest disk space in the current directory.

https://www.cyberciti.biz/faq/how-do-i-find-the-largest-filesdirectories-on-a-linuxunixbsd-filesystem/

du -a . | sort -n -r | head -n 10



Lab #7 - Get help on linux

Type command is used to determine if the command is built in or external

Zsh does not have help command (bash does)

ls --help

man ; manual

Chapter Number	Description

1	Standard commands
2	System calls
3	Library functions
4	Special devices
5	File formats
6	Games and toys
7	Miscellaneous
8	Administrative commands
9	Others

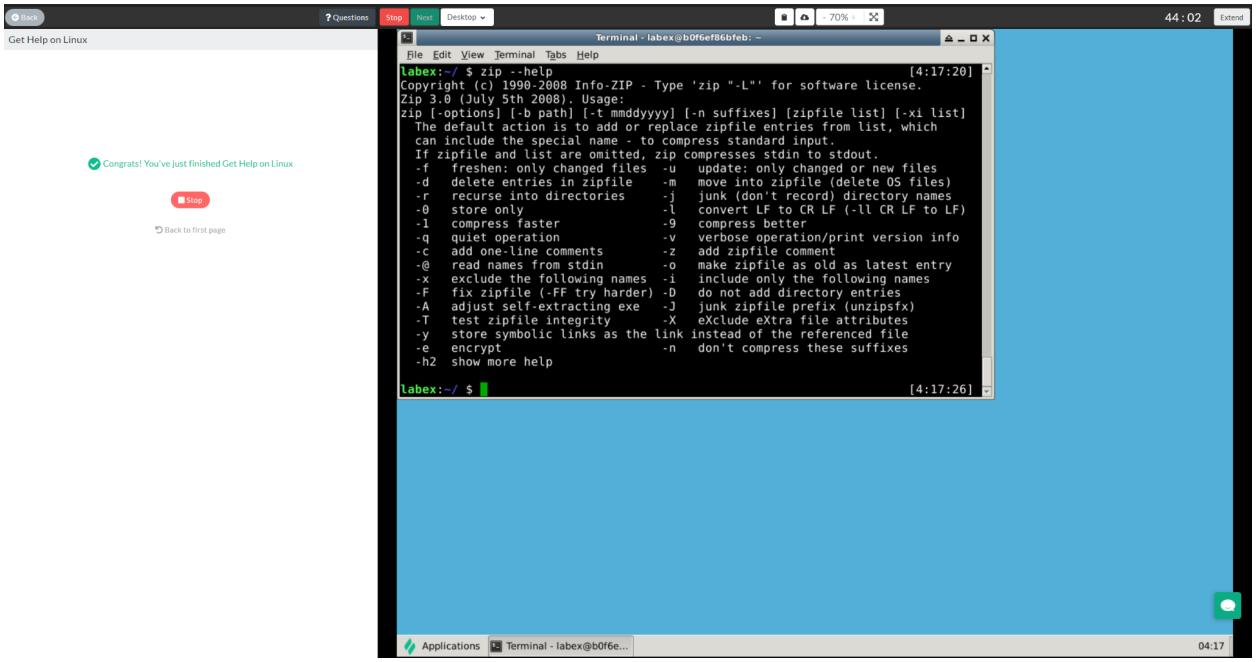
Info is a GNU project. It can have a more complete display of GNU information.

Homework

Try the help commands to get help for find and zip.

find --help

zip --help



Challenge #3

Backup System Logs

Bob is a server administrator. He needs to back up all the log files in /var/log/ folder. The backup file name is in year-month-day.tgz format with the date of today, such as 2017-11-01.tgz.

Tasks

Backup /var/log/ folder to /home/labex/tmp/year-month-day.tgz file. The name format is year-month-day.tgz. For example, if today is April 1, 2017, then the file name is 2017-04-01.tgz

Tar is used to save many files together. DD would not work because it cant copy directories.

Year-monthj-day.tgz

Dd if=/var/log/* of=2021-07-16.tgz

I am not sure if we are supposed to fill in the date manually or find a command.

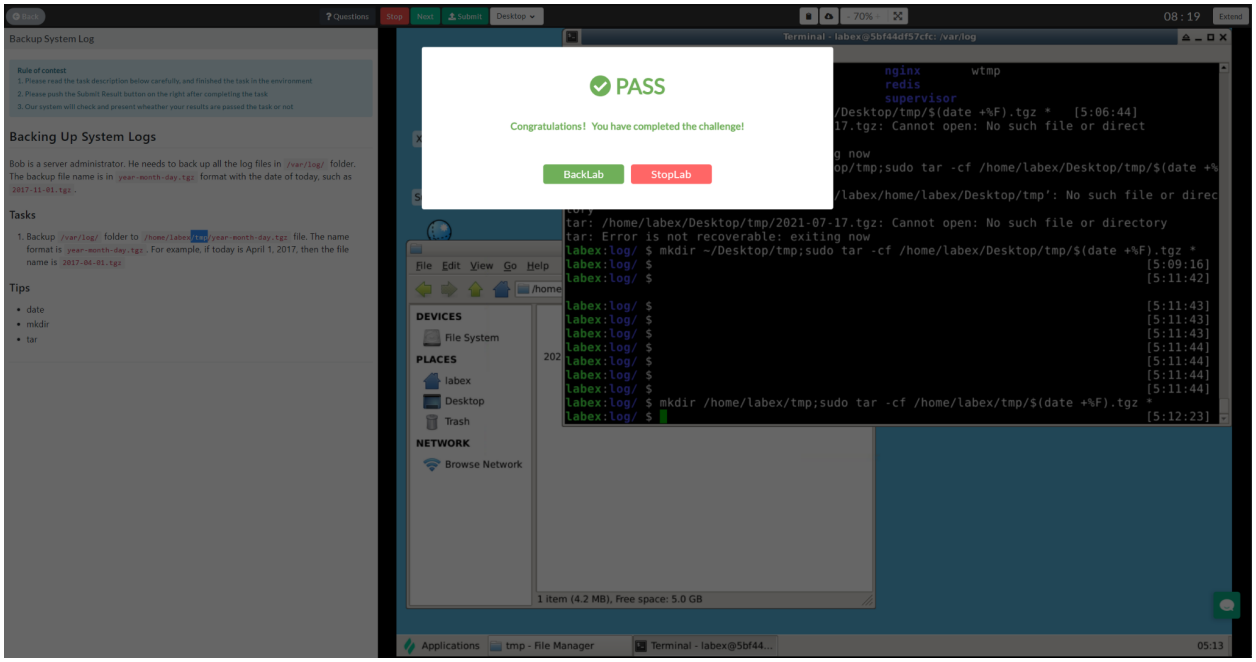
$(date +%F)

https://www.shell-tips.com/linux/how-to-format-date-and-time-in-linux-macos-and-bash/#:~:text=To%20format%20date%20in%20DD,T%5Cn%22%20%24EPOCHSECONDS%20.

After researching its best to be in the /var/log folder before running tar command

cd /var/log

mkdir /home/labex/tmp; sudo tar -cf /home/labex/tmp/$(date +%F).tgz *



Lab #8 - Command Execution Sequence Control and Pipeline

Executing sequentially vs optionally

; is bad because if the subsequent command is dependent on the result of the previous command, it will give wrong result

Which command basically finds out whether to install a command, if you find it the system will run the command.

&& both commands have to be successful or its not executed. First command has to be suciessful to run.

|| only one command has to work. First command fails, the second one will run.

Pipeline is a sequence of processes chained together by their standard streams, so that the output of each of the processes (stdout) feeds directly as input(stdin)

Ls -al /etc | less

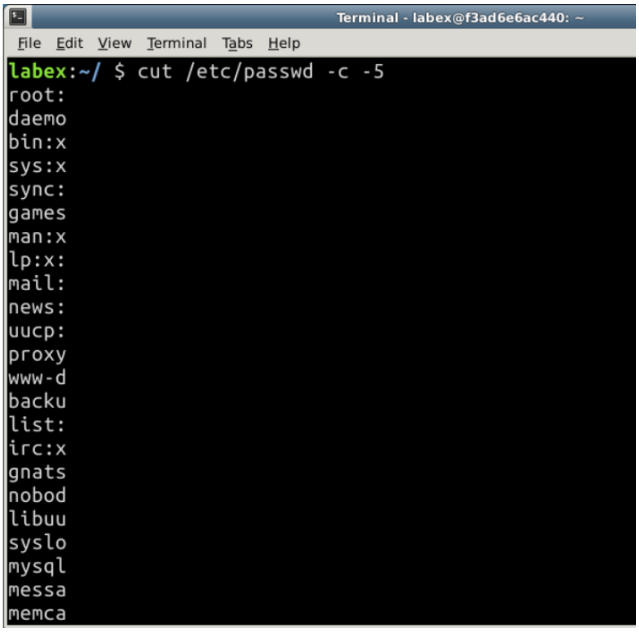
The output of the previous command (ls) is used as the input of the next command (less), and then we can view the output line by line.

Print the first field and the sixth field of each of the rows in the file /etc/passwd. The fields are separated by :. The first field and the sixth field represent the usernames and respective home directories:

cut /etc/passwd -d ':' -f 1,6

Print the first five characters (including the fifth one):

cut /etc/passwd -c -5



Prints teh characters after the frist five characters (including the 5th)

cut /etc/passwd -c 5-

-c charaacters

Prints out the 5th character

$ cut /etc/passwd -c 5

Grep is basically a very efficient match and search function.

grep [option]

expresinon _used_to match [file]

Grep -rnI “labex” ~

-r recurively search all subdirectories

-I binary files are ignored

View the strings in the environment variables ending with "bex":

```
$ export | grep ".*bex$"
```

Wc counts number of lines, words, and bytes in a file or the output stream of a command.

Wc /etc/passwd

Get number of lines

wc -l number of lines

-w gets number of words

-c bytes

-m number of caharcetsr

-L longest line of bytes

ls -dl /etc/*/ | wc -l

-d is directories

-l long listing

Number of folders in /etc

Sort the input in a certain way. In the dictionary, number, months, by random, and in reverse order. It can also sort by specific fields and so on.

By default / dictionary order

sort

In reverse

Sort -r

By specific fields

Sort -t':' -k 3

-t is used to spoecify a delimiter (so you remove :)

-k n is used to specify what files to sort by

-n is numeric sorting

Uniq

Used to filter dupl;icate rows or output diuplcate rows

This is used to view exuected commands buit we remove everything except the commands. We remove arguments from the commands and duplicate commands

$ history | cut -c 8- | cut -d ' ' -f 1 | uniq

History shows the history list

Cut -c 8- cuts out the blank lines in the history

Cut -d ‘ ‘ -f 1

-f means fields. It selects the first field

-d is deleminter. So the space

It selects the first field

Uniq removes dupluicates

When using uniq, always use sort because it only looks at consecutive lines.

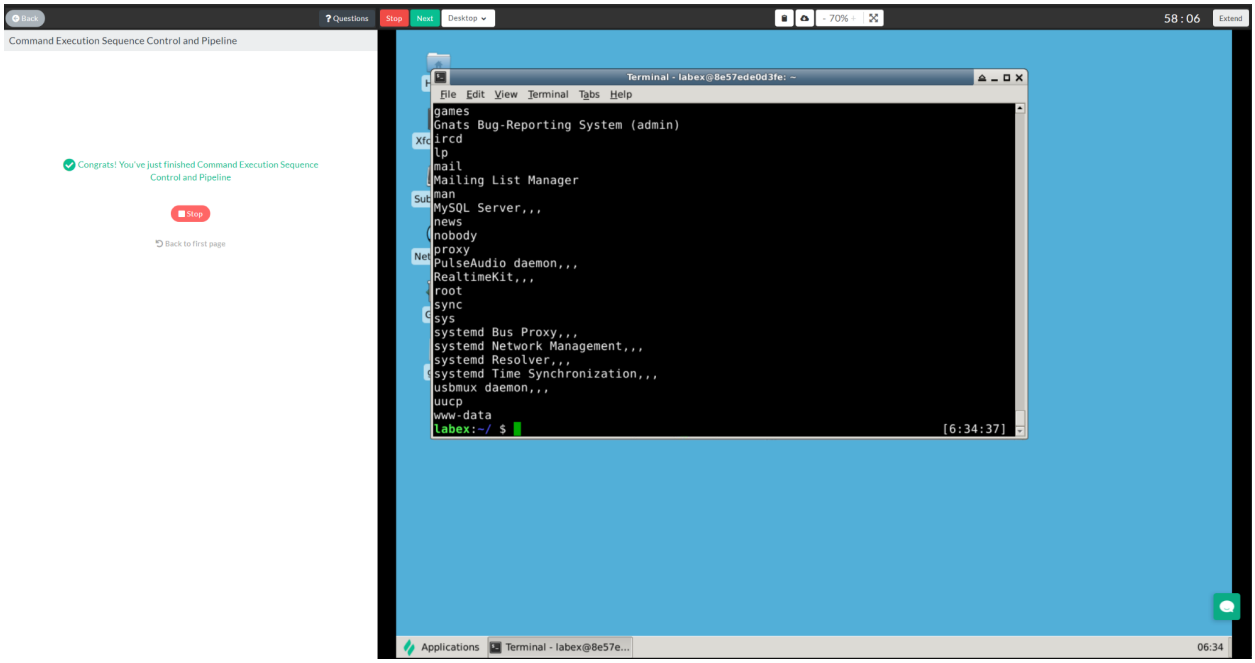
sort -u is the same as uniq

Homework

Try to use cut, sort and uniq with different parameters.

Select the 5th

cat /etc/passwd | cut -d ':' -f 5 | sort | uniq



Lab #9 - Simple Text Processing

Lab #10 - Command Execution Sequence Control and Pipeline

Lab #11 - Data Stream Redirection

Challenge 4 - Analyze Historical Commands

There Is a file called data1

Download here

wget https://labexfile.oss-us-west-1-internal.aliyuncs.com/courses/1/data1

you have to find the top three commands which are frequently shown in the file, and save the result in /home/labex/result.

1. Process the text data.
2. Write the result to `/home/labex/result`.
3. Ensure that results include the number of times and commands, such as "100 ls".

mkdir results

Based off the tips,

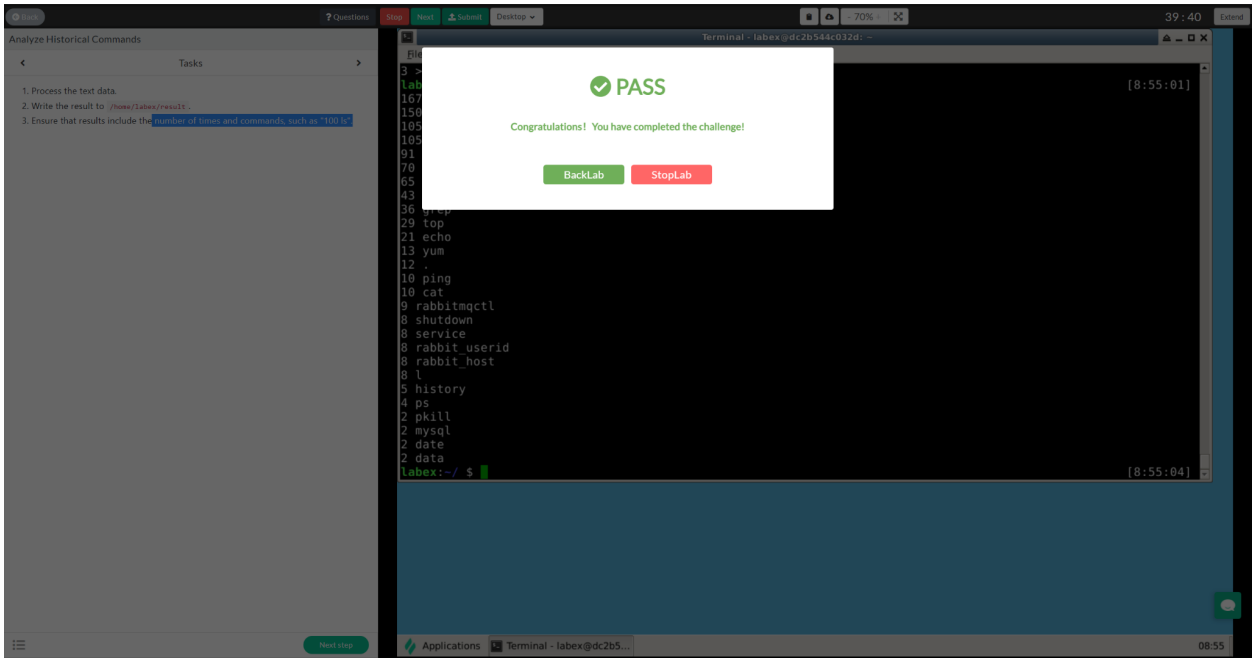
It has to have the number of times ran and number of commands

Cat data1 | cut -c 8- | cut -d ‘ ‘ -f 1 | sort | uniq -c | sort -nr > ./result/results.txt

Use tr command to squeeze it

cat data1 | cut -c 8- | cut -d ‘ ‘ -f 1 | sort | uniq -dc | sort -nr | tr -s ‘ ‘ | cut -d ‘ ‘ -f 2,3 > ./result

Cat result



Lab #12 - Regular Expression

Sed grep awk

* is a wildcard

- `+` can match the preceding pattern element one or multiple times. For example, "goo+gle", can match "gooogle", "goooogle" and so on;
- `?` can match the preceding pattern element zero or one time. For example, "colou?r" can match "color" or "colour";
- `*` can match the preceding pattern element zero or more times. For example, "0*42" can match "42", "042", "0042", "00042" and so on.

()

gr(a|e)y = gray|grey

(grand)?father" can match "father" and "grandfather".

\ merks the next character is a special character

^ matches the start position of the input string

$ matches the end position of the input string

{n} can only match with food

{n,} can only fooooooooooood

{n,m}

Zo+ can match zo and azoo but not z

(pattern) match the pattern and get matching substrings

(*@*.*)

X\y match x or y

[xyz] match any of the characters contained in []

[^xyz] a negative character set. Match any character that is not listed

[a-z] match any character within the rang

[^a-z] match any character that is not within the specified range

Match all strings that begin with 'z' and end with 'o':

```
$ echo 'zero\nzo\nzoo' | grep 'z.*o'
```

The following contains the complete list of special symbols and instructions:

Special Symbol	Description
[:alnum:]	Upper and lower case letters and digits (0-9, A-Z, a-z)
[:alpha:]	Any English uppercase and lowercase letters (A-Z, a-z)
[:blank:]	Blank key and [Tab]
[:cntrl:]	Control buttons on the top of the keyboard, including CR, LF, Tab, Del and so on
[:digit:]	Numeral digits (0-9)
[:graph:]	All the keys except for blank key (for example, Space) and [Tab]
[:lower:]	Lowercase letters (a-z)
[:print:]	Characters that can be printed out

`[:punct:]`	punctuation symbols (" ' ? ! ; : # $ ...)
`[:upper:]`	uppercase letters (A-Z)
`[:space:]`	Symbols include blank keys, [Tab], CR and so on
`[:xdigit:]`	Hexadecimal digits, including 0-9, A-F, a-f

Sed is stream editor for filterint and transforming text

```
sed [Parameters]... [Command] [File]...

# For example:

$ sed -i '1s/sad/happy/' test

#Replace the "sad" in the first line of the test with "happy"
```

Parameter	Description
`-n`	By default, each line of input is echoed to the standard output after all of the commands have been applied to it. The `-n` option suppresses this behavior.
`-e`	Append the editing commands specified by the command argument to the list of commands.
`-f filename`	Specify to execute the commands in the `filename` file.
`-r`	Use extended regular expressions, which default to standard regular expressions.

`-i`	Directly modify the contents of the input file instead of printing to standard output.

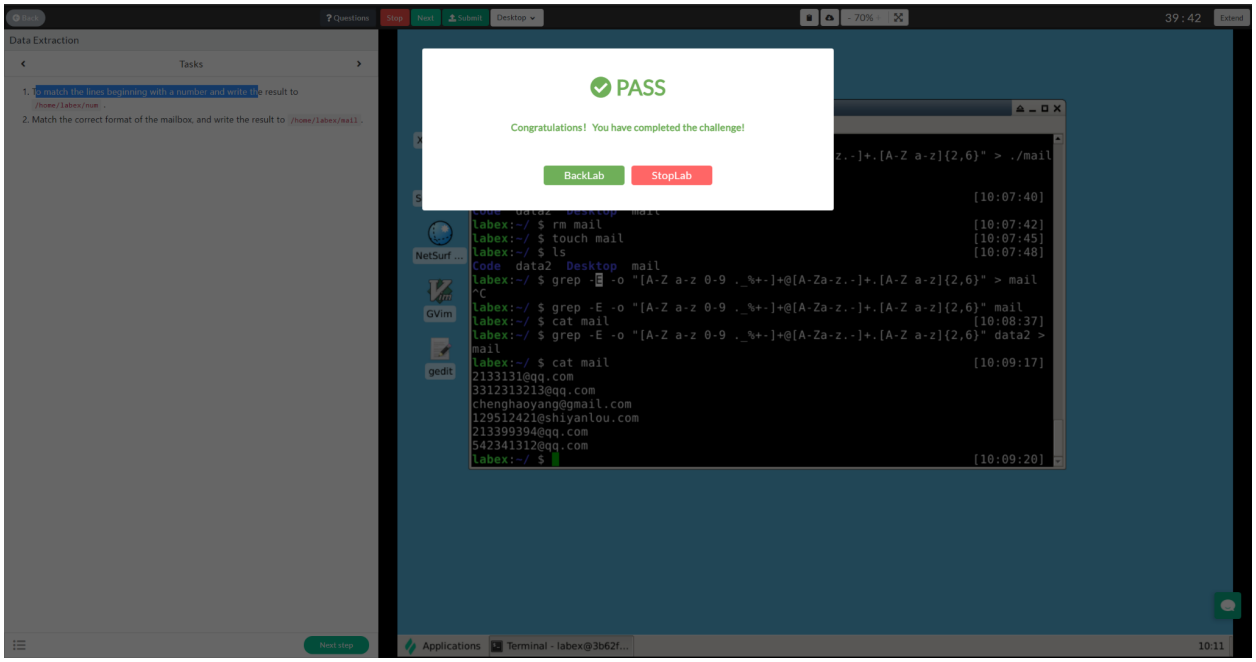
AWK is an excellent text processing tool, one of the most powerful data processing engines available in Linux and Unix environments

```
awk [-F fs] [-v var=value] [-f prog-file | 'program text'] [file...]
```

Challenge 5 - Data Extraction

wget http://labfile.oss-cn-hangzhou.aliyuncs.com/courses/1/data2

1. To match the lines beginning with a number and write the result to `/home/labex/num` .
2. Match the correct format of the mailbox, and write the result to `/home/labex/mail`.
3.



grep -E -o "[A-Z a-z 0-9 ._%+-]+@[A-Za-z.-]+.[A-Z a-z]{2,6}" data2 > mail

Lab #13 - Software Installation on Linux