

ICT246 Operating Systems

Tutor-Marked Assignment

January 2023 Presentation

TUTOR-MARKED ASSIGNMENT (TMA)

This assignment is worth **18%** of the final mark for **ICT246 Operating Systems**.

The cut-off date for this assignment is **Sunday, 05 Mar 2023, 2355 hours**

Note to Students:

You are to include the following particulars in your submission: Course Code, Title of the TMA, SUSS PI No., Your Name, and Submission Date.

Answer all questions. (Total 100 marks)

Question 1

Select a Linux operating system (OS) distribution and write 350 words on it. (Note that you cannot choose **Ubuntu** or **Debian**)

Explain the core functions of the Linux OS that you have chosen. Then choose a docker container that is based on the Linux OS that you have chosen and write on the unique features of this docker container.

In addition, describe what your chosen docker container is commonly used for. A reflection should be given at the end of the writeup to describe on your experience in using the chosen docker container. Appropriate references should be stated.

(15 marks)

Question 2

Demonstrate the creation and usage of virtual machine using Ubuntu OS.

Scenario:

A furniture company specialise in cabinets has purchased an Ubuntu server with **10 hard disks** (each hard disk has a storage size of 2 TB). The server is pre-installed with Ubuntu server 22.04 LTS on 2 hard disks that are configured as RAID 1.

The requirements for the storage space are stated as follow:

- 3.2 TB is needed for storing various marketing materials to promote various type of cabinets. **Redundancy is important and no data should be lost.**
- 1.1 TB is needed for the human resource and admin department to store internal and sensitive information. **Redundancy is important and no data should be lost.**
- 2.2 TB is needed for the design department to store all the design related work. Redundancy is critical and no data should be lost.
- A temporary storage space for all the staff for quick sharing of non-sensitive information. **It is estimated that this space will need 2.5 TB in the first year, and it will increase 30% in the second year, and it will grow by 50% (from second year) in the third year.** Performance is important but no redundancy is needed.

Implement ZFS for this scenario. Note that you do not need to implement ZFS for the 2 hard disks that host the Ubuntu OS.

Q2 (a)

Illustrate what RAID system(s) should be used for the scenario and why.

Calculate and explain how you plan and utilize the 8 hard disks. Sketch a diagram with necessary labelling such as hard disk used (/dev/sdc, /dev/sdd, etc.), pool name and file system name to help in your explanation.

(15 marks)

Q2 (b)

Install 8 additional hard disks in your Ubuntu virtual machine (you can use Ubuntu Desktop instead of Ubuntu Server) and simulate the scenario using ZFS with relevant pools and reservations.

Demonstrate what you have done with clear explanations and appropriate screenshots.

(15 marks)

Question 3

Implement system security and access control in Linux operating system.

Using Ubuntu OS, write and implement **ONE (1)** bash shell script (only one script should be written for whole Question 3). Copy the /etc/passwd file and /etc/group file into the same folder as your script and use the root account to execute the script. The script needs to execute on the “passwd” file and “group” file that have been copied to the folder, and not on the original /etc/passwd file and /etc/group file. That means some commands cannot be used in your script, such as id, getent, etc. You can assume that your script will not be executed in the /etc folder.

The bash shell script, which you need to name as tma.sh should have the following specifications:

Q3(a)

1. The script will be executed in the following manner:
./tma.sh passwd group

Example of content in “passwd” file:

```
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
ubuntu:x:1002:1002:/home/ubuntu:/bin/bash
```

Note that the UID and GID can be different.

Example of content in “group” file:

```
root:x:0:
daemon:x:1:
ubuntu:x:1002:
```

If the number of arguments is not equal to two, an error message will display, and the script will terminate.

2. It will check whether the format of the “passwd” file is in the correct format. If the format is not correct, an error message will prompt, and the script will terminate.
3. It will check whether the format of the “group” file is in the correct format. If the format is not correct, an error message will prompt, and the script will terminate.
4. It will create a file “userpassword” with only the user accounts details (you can assume that the user account is having a shell of /bin/bash or /bin/sh)

Example of content in “userpassword” file:

```
root:x:0:0:root:/root:/bin/bash
ubuntu:x:1002:1002::/home/ubuntu:/bin/bash
```

(15 marks)

Q3(b)

1. The script will then display the content of “userpassword” file on screen
2. It will create a new file “combinepwgp” with the following format for each line:

Username-GroupName-HomeDirectory-LoginShell

Example of content inside combinepwgp file:

```
root-root-/root-/bin/bash
ubuntu-ubuntu-/home/ubuntu-/bin/bash
```

3. It will display the content of “combinepwgp” file on screen. The permissions and owner of the file “combinepwgp” will be displayed next on screen. (Note: the rest of information on the file, such as size, group, date, etc. should not be displayed)
4. It will then append the current date and time to the “combinepwgp” file in the format of DD-MM-YY:HH:mm (note: this should not be displayed on the screen)

(15 marks)

Q3(c)

1. The script will then display the following on screen:
 - total number of user accounts
 - largest user id among all the user accounts
2. The following will then be changed:
 - Owner and group of “userpassword” file to user ‘ubuntu’
 - Permissions of “userpassword” file to the owner can read, write and execute, and all others can only read
3. The owner, group and permissions of the file “combinepwgp” will be appended to the “combinepwgp” file in the format of owner:group:permissions (note: this should not be displayed on the screen)

(10 marks)

Q3(d)

A documentation (with appropriate screenshots and explanations) needs to be produced on the execution of the bash shell script with different conditions (e.g. correct number of arguments, incorrect number of arguments, etc.). Necessary checking needs to be done (e.g. check that the permissions of the file “userpassword” has changed, etc.).

Appropriate comments should be added in the script to make it easier to understand.

(15 marks)

IMPORTANT NOTE TO STUDENTS:

- Your bash shell script must be in text format within the WORD document. In addition, add a notepad attachment of the script in the WORD document. Note that your script should be able to execute in any folder, and marks will be deducted heavily if you hardcode any filepath in your code.

A zero will be given for the following:

- You are not using bash shell script, or your bash shell script cannot be executed in the Ubuntu virtual machine as instructed by the instructor.
- The instructor cannot copy the bash shell script from your WORD document to test, such as if you paste the bash shell script in WORD document as an image, and your notepad attachment is corrupted.

At least 50% of the marks will be deducted if your bash shell script does not work according to your documentation produced in Q3(d).

---- END OF ASSIGNMENT ----