DAT151
Database and Unix System Management

Spring 2024

Assignment 1

Obligatory assignment. Deadline: ***Sunday 04.02.2024***

The report should include all necessary commands to complete the tasks, printout from the system, explanation of what is done, the result and explanation of the result.

Remember to include the names of the group members on the front page of the report. The report can be in English or Norwegian. The report should be handed in via Canvas.

The assignment should be accomplished in groups of two to three students. Signing up for a group will be closed on Thursday 01.02.

You must select a group "Lab1 N" when delivering report, also if you are the only member of the group..

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Part 1 – The Filesystem

Task 1: Filesystem basics

1. Describe some of the key differences between the Linux/UNIX filesystem and Windows. How are files and folders organised in Linux/UNIX?
2. What is a "mount point"?

   Comment out/remove the reference to the extra 10GiB partition from the file /etc/fstab and then un-mount the partition using the **umount** command.

   Create a new folder below /opt. Then use the **mount** command and mount the 10GiB partition on the new directory. Explain the outcome.
3. In most UNIX systems, there are seven types of files defined. What are these? Use the **file** command to display the information of a few files. In which of the seven categories do these files belong?

   Hints:

- Remember that many things can be considered as “regular files”, such as texts and executables.
- The command **ls -l** can display the exact type of all files in a directory. Look at the very first letter of each line. If there is no letter (instead only a “-”), then it’s a regular file.

4. From a user perspective, hard links and symbolic links allow the same file to exist in more than one place. Find an empty directory and create a new file with some text in it. Create a hard link for this file in the same directory using the command **ln**. Now, create a symbolic link for the file using **ln -s**. Then delete the original file, leaving only the links.
   a) Check if the hard link still works. Why/why not?
   b) Check if the soft link still works. Why/why not?

Task 2: File attributes and permissions

1. In the traditional Linux/UNIX filesystem model, every file comes bundled with a set of 16 bits. What are these bits, and why are they needed? Explain.
2. The nine permission bits are often represented using octal numbers. Explain what these are, and how the permissions bits 110 100 101 can be represented using octals. What permissions does a file with the octal value 745 have?
3. **chmod** is a tool that allows users to change the permission bits of a file, either by providing octal values, or by a mnemonic syntax where you can combine a set of targets (**u**, **g**, **o** for user, group and others, or **a** for all three) combined with an operator (**+** , **-** , **=** for add, remove or set) before providing the wanted permissions. For instance, to add read and write permissions to the group and all others for a file, the command **chmod go+rw** can be used.
   a) Create a new file and use **chmod** with the mnemonic syntax to add read and write permissions to the file owner, read and execute permissions for the group, and read and execute permissions for everyone else.
   b) Create a second file with the same permissions, but now use **chmod** with octal numbers to set the permissions.
   c) Can you think of any reasons why octal numbers can be preferred over the mnemonic syntax?

Part 2 – Software installation and management

Task 3: Package management systems and lower level package management

1. What is a package management system, and why do we need one? What is the package format used by the package management system on your machine?
2. Package management can often be considered to have two layers, where lower level package management contains tools used to install, uninstall and query packages.

a) Use the package management tool available on your system to list all installed packages. How many are installed on your system? Select one package and use the tool again to display all its dependencies.

   Hints:

b) Use **wget** to download the package for the application called **openvpn**. Use an official AlmaLinux repository.

   Tip: Check the URLs for AlmaLinux under /etc/yum.repos.d

c) Try to install this package using your system's packaging tool. What happens? Why?

Task 4: High-level package management

High-level package management systems aim to simplify the process of installing, updating and maintaining packages. The two most common of these systems are **apt** (the Advanced Package Tool) and **dnf** (Dandified YUM).

1. Explain how these systems can locate and install software. What is the high-level package management system on your machine?
2. What is a software repository? If you are using *dnf* as your high-level package management system, add the **epel** software repository to your system. If you are using something else try a different repository of choice.

   Hints:
   - More information available at http://fedoraproject.org/wiki/EPEL
   - Use **dnf** and intall the "epel-release" package, that adds the **epel** software.
3. Try using **dnf** to install the **openvpn** package. Does this differ in any way from task 3? If it installs, remove the package afterwards.

   Hints:
   - The **dnf** have command named **install, remove a**nd **history**
   - The history sub command *undo* can be very useful.
   - Simply type **dnf** in your terminal to see a list of all available commands.
   - More information is available through the man system.
4. Use **dnf** to update the packages on your system.

Part 3 – Systemd

Task 1 Systemd

1. The **ctrl-alt-del.target** is started whenever *Control+Alt+Del* is pressed on the console. This target will be symlinked to another target.

   a) What is the current target that **ctrl-alt-del.target** points to, and what are the consequences?

   b) Modify the **ctrl-alt-del.target** to halt the computer when *Control+Alt+Del* is pressed.

      - Do not modify the content of the file pointed to by **ctrl-alt-del.target**. Rather, modify the target of the symlink.

2. Set the systemd **default.target** to **multi-user.target**, then restart the computer.
   - Modify the target of the symlink using the systemctl command.

   What is the consequences of the **multi-user.target**. Obs: Write down the current value of **default.target** before modifying its value.

   When in the **multi-user.target,** Use the systemctl isolate command and start the graphical target.
3. Reboot the computer, and boot into the **emergency.target**. Mount the root file system (/) rw, and create a file in the **/root** directory. Then restart the computer.
4. Only if the previous task was solved, modify the root file system stanza in the /*etc/fstab* file and use a wrong value. **Obs.:** Take a copy of the *fstab* file before modifying it.

   Reboot the computer. When the mount fails, the kernel will start the emergency target. Use the emergency shell, and correct the */etc/fstab* file, then restart the computer.
5. Create a directory *ram* below your home directory. Create a systemd mount unit that mounts a ramdisk on the *ram* directory.