

# File permissions in Linux

## Project description

The research team at my organization needs to update the file permissions for certain files and directories within the `projects` directory. The permissions do not currently reflect the level of authorization that should be given. Checking and updating these permissions will help keep their system secure. To complete this task, I performed the following tasks:

## Check file and directory details

The following code demonstrates how I used Linux commands to determine the existing permissions set for a specific directory in the file system.

```
researcher2@0dca9e6f70aa:~$ pwd
/home/researcher2
researcher2@0dca9e6f70aa:~$ ls
projects
researcher2@0dca9e6f70aa:~$ cd projects
researcher2@0dca9e6f70aa:~/projects$ pwd
/home/researcher2/projects
researcher2@0dca9e6f70aa:~/projects$ ls -l
total 20
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-rw- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw-r----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$ ls -la
.  ..  .project_x.txt  drafts  project_k.txt  project_m.txt  project_r.txt  project_t.txt
researcher2@0dca9e6f70aa:~/projects$
```

The first line of the screenshot displays the command I entered, and the other lines display the output. The code lists all contents of the `projects` directory. I used the `ls` command with the `-la` option to display a detailed listing of the file contents that also returned hidden files. The output of my command indicates that there is one directory named `drafts`, one hidden file named `.project_x.txt`, and five other project files. The 10-character string in the first column represents the permissions set on each file or directory.

## Describe the permissions string

The 10-character string can be deconstructed to determine who is authorized to access the file and their specific permissions. The characters and what they represent are as follows:

- **1st character:** This character is either a `d` or hyphen (`-`) and indicates the file type. If it's a `d`, it's a directory. If it's a hyphen (`-`), it's a regular file.
- **2nd-4th characters:** These characters indicate the read (`r`), write (`w`), and execute (`x`) permissions for the user. When one of these characters is a hyphen (`-`) instead, it indicates that this permission is not granted to the user.
- **5th-7th characters:** These characters indicate the read (`r`), write (`w`), and execute (`x`) permissions for the group. When one of these characters is a hyphen (`-`) instead, it indicates that this permission is not granted for the group.
- **8th-10th characters:** These characters indicate the read (`r`), write (`w`), and execute (`x`) permissions for other. This owner type consists of all other users on the system apart from the user and the group. When one of these characters is a hyphen (`-`) instead, that indicates that this permission is not granted for other.

For example, the file permissions for `project_t.txt` are `-rw-rw-r--`. Since the first character is a hyphen (`-`), this indicates that `project_t.txt` is a file, not a directory. The second, fifth, and eighth characters are all `r`, which indicates that user, group, and other all have read permissions. The third and sixth characters are `w`, which indicates that only the user and group have write permissions. No one has execute permissions for `project_t.txt`.

## Change file permissions

The organization determined that other shouldn't have write access to any of their files. To comply with this, I referred to the file permissions that I previously returned. I determined `project_k.txt` must have the write access removed for other.

The following code demonstrates how I used Linux commands to do this:

```
researcher2@0dca9e6f70aa:~/projects$ chmod o-w project_k.txt
researcher2@0dca9e6f70aa:~/projects$ ls -l
total 20
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw-r----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$ chmod g-r project_m.txt
researcher2@0dca9e6f70aa:~/projects$ ls -l
total 20
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$
```

The first two lines of the screenshot display the commands I entered, and the other lines display the output of the second command. The `chmod` command changes the permissions on files and directories. The first argument indicates what permissions should be changed, and the second argument specifies the file or directory. In this example, I removed write permissions from other for the `project_k.txt` file. After this, I used `ls -la` to review the updates I made.

## Change file permissions on a hidden file

The research team at my organization recently archived `project_x.txt`. They do not want anyone to have write access to this project, but the user and group should have read access.

The following code demonstrates how I used Linux commands to change the permissions:

```
researcher2@0dca9e6f70aa:~/projects$ ls -a
.  ..  .project_x.txt  drafts  project_k.txt  project_m.txt  project_r.txt  project_t.txt
researcher2@0dca9e6f70aa:~/projects$ ls -la
total 32
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 22:40 .
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 23:31 ..
-rw--w---- 1 researcher2 research_team  46 Sep 19 22:40 .project_x.txt
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$ chmod g+r,u-w,g-w .project_x.txt
researcher2@0dca9e6f70aa:~/projects$ ls -la
total 32
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 22:40 .
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 23:31 ..
-r--r----- 1 researcher2 research_team  46 Sep 19 22:40 .project_x.txt
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$
```

The first two lines of the screenshot display the commands I entered, and the other lines display the output of the second command. I know `.project_x.txt` is a hidden file because it starts with a period (`.`). In this example, I removed write permissions from the user and group, and added read permissions to the group. I removed write permissions from the user with `u-w`. Then, I removed write permissions from the group with `g-w`, and added read permissions to the group with `g+r`.

## Change directory permissions

My organization only wants the `researcher2` user to have access to the `drafts` directory and its contents. This means that no one other than `researcher2` should have execute permissions.

The following code demonstrates how I used Linux commands to change the permissions:

```
researcher2@0dca9e6f70aa:~/projects$ ls -la
total 32
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 22:40 .
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 23:31 ..
-r--r----- 1 researcher2 research_team  46 Sep 19 22:40 .project_x.txt
drwx--x--- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$ chmod g-x drafts
researcher2@0dca9e6f70aa:~/projects$ ls -la
total 32
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 22:40 .
drwxr-xr-x 3 researcher2 research_team 4096 Sep 19 23:31 ..
-r--r----- 1 researcher2 research_team  46 Sep 19 22:40 .project_x.txt
drwx----- 2 researcher2 research_team 4096 Sep 19 22:40 drafts
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_k.txt
-rw----- 1 researcher2 research_team  46 Sep 19 22:40 project_m.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_r.txt
-rw-rw-r-- 1 researcher2 research_team  46 Sep 19 22:40 project_t.txt
researcher2@0dca9e6f70aa:~/projects$
```

The output here displays the permission listing for several files and directories. Line 1 indicates the current directory (`projects`), and line 2 indicates the parent directory (`home`). Line 3 indicates a regular file titled `.project_x.txt`. Line 4 is the directory (`drafts`) with restricted permissions. Here you can see that only `researcher2` has execute permissions. It was previously determined that the group had execute permissions, so I used the `chmod` command to remove them. The `researcher2` user already had execute permissions, so they did not need to be added.

## Summary

I changed multiple permissions to match the level of authorization my organization wanted for files and directories in the `projects` directory. The first step in this was using `ls -la` to check the permissions for the directory. This informed my decisions in the following steps. I

then used the `chmod` command multiple times to change the permissions on files and directories.