# File permissions in Linux

## Project description

We are going to keep the system of the organization secure, and to accomplish this, we will have to ensure that the users on the research team have the appropriate permissions.

In this project we will examine existing permissions on the file system, and determine if the permissions match the authorization that should be given. We will be using some basic but important commands in the Shell of Linux: navigate through the FHS (File Hierarchy System) and manage permissions of directories and files.

## Check file and directory details

With the following commands, we first create an alias. With this alias we can just type ll and it would show the absolute path of the directory where we are (pwd), followed by its list of files (including the hidden files) and subdirectories, with all their permission details (ls -la). In the second line, we use the command and see what it does now:

|  |
| --- |
| researcher2@5f05322d7eb6:~$ alias ll="pwd && ls -la"  researcher2@5f05322d7eb6:~$ ll  /home/researcher2  total 32  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 11:06 .  drwxr-xr-x 1 root root 4096 Oct 25 10:22 ..  -rw------- 1 researcher2 research\_team 31 Oct 25 11:06 .bash\_history  -rw-r--r-- 1 researcher2 research\_team 220 Apr 18 2019 .bash\_logout  -rw-r--r-- 1 researcher2 research\_team 3574 Oct 25 10:22 .bashrc  -rw-r--r-- 1 researcher2 research\_team 3574 Oct 25 10:22 .profile  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 10:22 projects |

Our new command is working, and we will use it a lot. Now we enter the “projects” subdirectory:

|  |
| --- |
| researcher2@5f05322d7eb6:~$ cd projects/ |

## Describe the permissions string

By typing ll the output would show us the following:

|  |
| --- |
| researcher2@5f05322d7eb6:~/projects$ ll  /home/researcher2/projects  total 32  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 10:22 .  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 11:06 ..  -rw--w---- 1 researcher2 research\_team 46 Oct 25 10:22 .project\_x.txt  drwx--x--- 2 researcher2 research\_team 4096 Oct 25 10:22 drafts  -rw-rw-rw- 1 researcher2 research\_team 46 Oct 25 10:22 project\_k.txt  -rw-r----- 1 researcher2 research\_team 46 Oct 25 10:22 project\_m.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_r.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_t.txt |

We see the absolute path of the directory “projects” (where we are now) and a detailed list of the contents. Now we are going to explain each column of the list.

In the first column, we have the permissions of each file and subdirectory. As we can see, it’s a 10-character string, which we explain in order:

* **1st character**: we see it can be either a “d” or a hyphen. With the “d” it indicates that it’s a directory. With the hyphen, it’s a file.
* **2, 3, and 4**: the next 3 characters indicates the permissions of the user (u).
* **5, 6, and 7**: the following 3 characters, indicates the permissions of the group (g).
* **8, 9 and 10**: the last 3 characters indicates the permissions of the rest (o).

These permission values are (in order):

* **R**: means read permission is granted.
* **W**: means write permission is granted.
* **X**: means execute permission is granted. It is used for executables or directories.

If there’s a **hyphen**, it means that the permission isn’t granted.

The second and third column are the user and group that owns the file or subdirectory respectively.

The fourth column is the size, fifth is the date of last modification, and last, the name of the file or subdirectory.

## Change file permissions

In the current directory, we’ve seen in the previous section that we needed to change the permissions of some files.

The file “project\_k.txt” needs the write permission to be taken away from the others. The file “project\_m.txt” needs to be readable and writeable just for the user. We proceed:

|  |
| --- |
| researcher2@5f05322d7eb6:~/projects$ chmod o-w project\_k.txt  researcher2@5f05322d7eb6:~/projects$ chmod g-r project\_m.txt  researcher2@5f05322d7eb6:~/projects$ ll  /home/researcher2/projects  total 32  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 10:22 .  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 11:06 ..  -rw--w---- 1 researcher2 research\_team 46 Oct 25 10:22 .project\_x.txt  drwx--x--- 2 researcher2 research\_team 4096 Oct 25 10:22 drafts  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_k.txt  -rw------- 1 researcher2 research\_team 46 Oct 25 10:22 project\_m.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_r.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_t.txt |

We’ve used the command chmod to change the permissions of each file or directory. In this command, we used two parameters or arguments, separated by a space:

* The first argument is where we specify the changes that we want to make. We define the permissions for the user (u), group (g) or others (o) and we separate each modification with commas. The permission is set by specifying the user and a sign, which can be a + (which indicates that we want to add) or a – (which indicates that we want to remove), followed by the permission, which is read (r), write (w) or execute (x).
* The second argument is the name of the file or directory we want to modify.

## Change file permissions on a hidden file

We also need to change the permissions of the hidden file, which we recognize because it starts with a dot. The permissions we set is only read for the user and group:

|  |
| --- |
| researcher2@5f05322d7eb6:~/projects$ chmod u-w,g-w,g+r .project\_x.txt  researcher2@5f05322d7eb6:~/projects$ ll  /home/researcher2/projects  total 32  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 10:22 .  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 11:06 ..  -r--r----- 1 researcher2 research\_team 46 Oct 25 10:22 .project\_x.txt  drwx--x--- 2 researcher2 research\_team 4096 Oct 25 10:22 drafts  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_k.txt  -rw------- 1 researcher2 research\_team 46 Oct 25 10:22 project\_m.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_r.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_t.txt |

## Change directory permissions

Finally, the directory “drafts” also needs to be corrected. Only the user should have all the rights over it:

|  |
| --- |
| researcher2@5f05322d7eb6:~/projects$ chmod g-x drafts  researcher2@5f05322d7eb6:~/projects$ ll  /home/researcher2/projects  total 32  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 10:22 .  drwxr-xr-x 3 researcher2 research\_team 4096 Oct 25 11:06 ..  -r--r----- 1 researcher2 research\_team 46 Oct 25 10:22 .project\_x.txt  drwx------ 2 researcher2 research\_team 4096 Oct 25 10:22 drafts  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_k.txt  -rw------- 1 researcher2 research\_team 46 Oct 25 10:22 project\_m.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_r.txt  -rw-rw-r-- 1 researcher2 research\_team 46 Oct 25 10:22 project\_t.txt |

## Summary

We’ve used commands like ls -la or chmod in this project, and we see how important they are for a security analyst. We’ve been using ls -la multiple times, so we created an alias to be more productive during the whole project. With these commands we’re able to check the file system and make the needed corrections.