

# UNIVERSITY INSTITUTE OF COMPUTING

## PROJECT REPORT

ON

### User & Group Management with Access Control

**Program Name: BCA**

**Linux Administration**

**23CAP-305**

#### SUBMITED BY:

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Semester :5<sup>TH</sup>

SUBMITION DATE : 03-Nov-2025

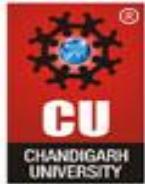
#### SUBMITED TO:

Name :Mr. Rajat Patiyal

SUBMITION DATE : 03-Nov-2025

Desigination : Asst. Professor

sign: \_\_\_\_\_



## BONAFIDE CERTIFICATE

Certified that this project report "**User & Group Management with Access Control**"  
is the Bonafide work of "**Akshay Kumar**" under UID "**23BCA10262**" who carried out  
the project work under my supervision.

.....  
**SIGNATURE**

**UIC DEPARTMENT**

**ASSISTANT PROFESSOR**

**RAJAT PATIYAL**

# LINUX ADMINISTRATION

## TITLE: User & Group Management with Access Control

### Aim of the Project:

The aim of this project is to implement and demonstrate user and group management with access control in a Linux environment. The project focuses on creating and managing users, groups, and directory permissions to ensure secure and efficient access to system resources. It also includes the use of Access Control Lists (ACLs) to provide fine-grained control over file and directory permissions, enabling flexible collaboration between multiple users such as *Ashu* (developer) and *Nikhil* (tester)

### Performing Task:

**Introduction:** This project demonstrates the process of managing users, groups, and access permissions in a Linux environment using Access Control Lists (ACL). It involves creating groups, adding users, setting permissions, verifying access, and modifying configurations to ensure fine-grained control over shared directories.

### Objectives:

- The main objective of this project is to understand and implement Linux user and group management along with ACLs to provide specific access controls for different users in a shared directory.

## Tools and Technologies Used:

- ❑ **Operating System:** Ubuntu Linux
- ❑ **Command Line Interface (Terminal):** Used to run all Linux commands
- ❑ **User and Group Management Commands:** useradd, groupadd, passwd, usermod, deluser, groupdel
- ❑ **Permission Commands:** chmod, chown
- ❑ **Access Control Commands:** setfacl, getfacl
- ❑ **Directory and File Commands:** mkdir, ls, cd, touch
- ❑ **Verification Commands:** id, getent, cat /etc/passwd
- ❑ **Software Used:** ACL package (installed using sudo apt install acl)
- ❑ **Editor (optional):** Nano or Vim for editing configuration files

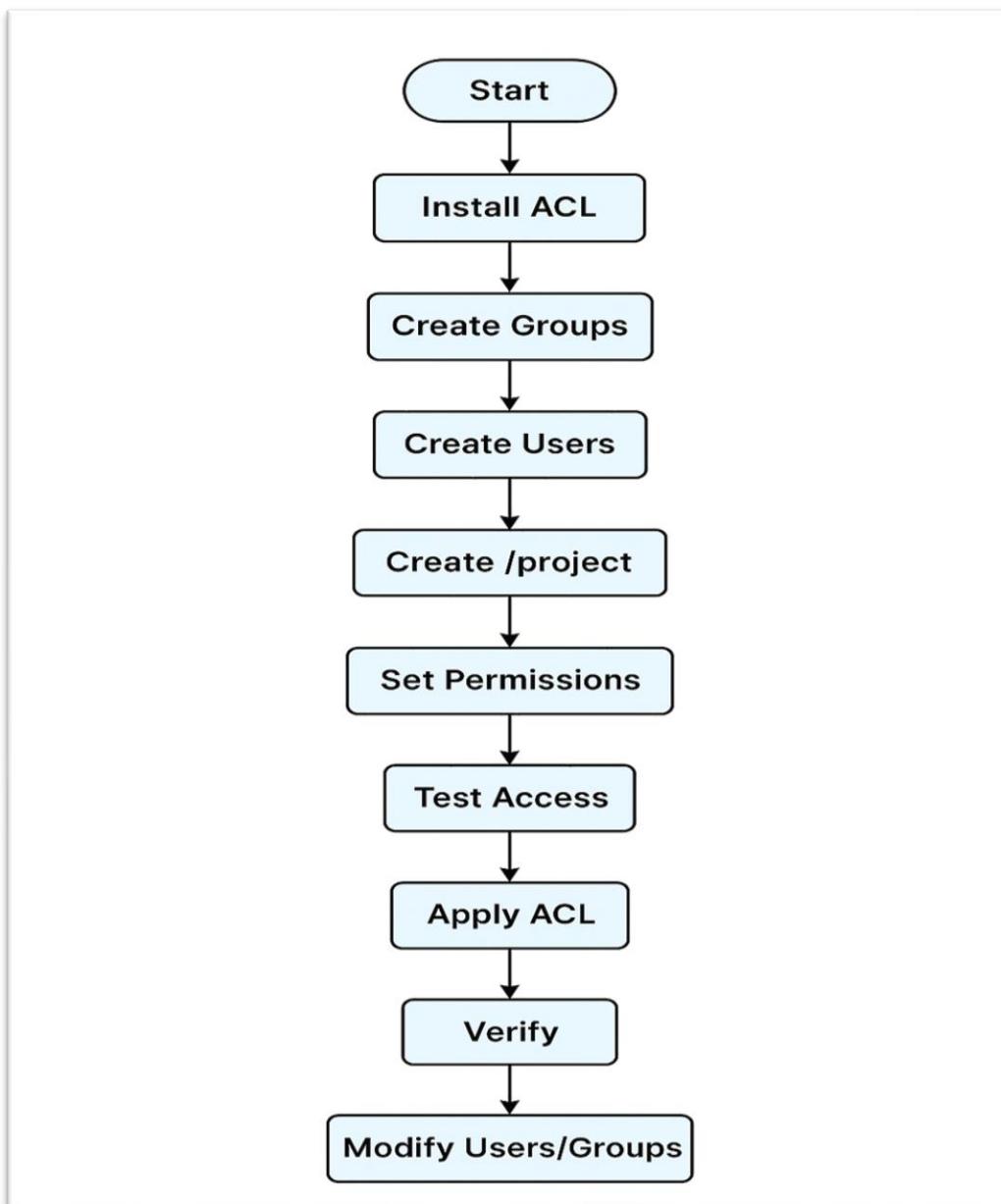
## Algorithm / Logic / Flow chart:

### ❑ Start

- ❑ Update system and install ACL package
- ❑ Create two groups — *Developers* and *Testers*
- ❑ Create two users — *Ashu* (Developer) and *Nikhil* (Tester)
- ❑ Create a shared directory /project
- ❑ Set ownership of /project to root and group *Developers*
- ❑ Give read, write, and execute permissions to the *Developers* group
- ❑ Test access for both users (Ashu can access, Nikhil cannot)
- ❑ Use **setfacl** to give *Nikhil* special access to /project

- ❑ Verify ACL permissions using **getfacl**
- ❑ Test default ACLs so new files get correct permissions automatically
- ❑ Modify or remove users/groups if needed
- ❑ **End**

## Flowchart (Description):





## Code Overview:

```
Akshay@Akshay:~$ sudo apt update
[sudo] password for Akshay:
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1,270 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,573 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [211 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [9,008 B]
Get:10 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2,080 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/main Translation-en [297 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.4 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [2,226 kB]
Get:15 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [470 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [505 kB]
Get:17 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:18 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [906 kB]
Get:19 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:20 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,498 kB]
Get:21 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [203 kB]
Get:22 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.2 kB]
Get:23 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [19.4 kB]
Get:24 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:25 http://archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [303 kB]
Get:26 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:27 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.4 kB]
Get:28 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:29 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,160 B]
Get:30 http://archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [212 B]
Get:31 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [11.0 kB]
Get:32 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Fetched 12.6 MB in 6s (2,258 kB/s)
Reading package lists... Done
All done.
```

```
Fetched 12.6 MB in 6s (2,258 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
172 packages can be upgraded. Run 'apt list --upgradable' to see them.
Akshay@Akshay:~$ sudo apt install -y acl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
acl is already the newest version (2.3.2-1build1.1).
acl set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 172 not upgraded.
Akshay@Akshay:~$ sudo groupadd Developers
Akshay@Akshay:~$ sudo groupadd Testers
Akshay@Akshay:~$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog
tty:x:5:
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:
uucp:x:10:
man:x:12:
proxy:x:13:
kmem:x:15:
dialout:x:20:
fax:x:21:
voice:x:22:
cdrom:x:24:
floppy:x:25:
tape:x:26:
sudo:x:27:Akshay
Akshay:x:28:
```

```
uidd:x:103:
ssh:x:104:
css:x:105:
ssl-cert:x:106:
systemd-oom:x:990:
bluetooth:x:107:
rdma:x:108:
whoopsie:x:109:
netdev:x:110:
avahi:x:111:
tcpdump:x:112:
sssd:x:113:
lpadmin:x:114:
fwupd-refresh:x:989:
scanner:x:115:saned
saned:x:116:
geoclue:x:117:
pipewire:x:118:
gnome-remote-desktop:x:988:
polkitd:x:987:
rtkit:x:119:
colord:x:120:
gdm:x:121:
nm-openvpn:x:122:
lxd:x:123:
gamenode:x:986:
gnome-initial-setup:x:985:
Akshay:x:1000:
23BCA:x:1001:
8ca:x:1003:
student1:x:1005:
tgroup:x:1006:
teamgroup:x:1007:
ubuntu:x:1008:
Developers:x:1009:
Testers:x:1010:
```



```
Akshay@Akshay:~$ getent group Developers Testers
Developers:x:1009:
Testers:x:1010:
Akshay@Akshay:~$ sudo useradd -m -s /bin/bash -G Developers Akshay1
useradd: user 'Akshay1' already exists
Akshay@Akshay:~$ sudo useradd -m -s /bin/bash -G Developers Ashu
Akshay@Akshay:~$ sudo passwd Ashu
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: password updated successfully
Akshay@Akshay:~$ sudo useradd -m -s /bin/bash -G Testers nikhil
Akshay@Akshay:~$ sudo passwd nikhil
New password:
BAD PASSWORD: The password contains the user name in some form
Retype new password:
passwd: password updated successfully
Akshay@Akshay:~$ id Ashu
uid=1006(Ashu) gid=1012(Ashu) groups=1012(Ashu),1009(Developers)
Akshay@Akshay:~$ id nikhil
uid=1007(nikhil) gid=1013(nikhil) groups=1013(nikhil),1010(Testers)
Akshay@Akshay:~$ sudo mkdir /project
Akshay@Akshay:~$ sudo chown root:Developers /project
Akshay@Akshay:~$ sudo chmod 770 /project
Akshay@Akshay:~$ ls -ld /project
drwxrwx---. 2 root Developers 4096 Nov  2 07:25 /project
Akshay@Akshay:~$ sudo -u Ashu bash -c 'touch /project/Ashu_file && echo "Hello from Ashu" > /project/Ashu_file && ls -l /project'
total 4
-rw-rw-r--. 1 Ashu Ashu 16 Nov  2 07:31 Ashu_file
Akshay@Akshay:~$ sudo -u nikhil bash -c 'ls -ld /project || echo "Access denied for Nikhil"'
drwxrwx---. 2 root Developers 4096 Nov  2 07:31 /project
Akshay@Akshay:~$ sudo setfacl -m u:nikhil:rwx /project
Akshay@Akshay:~$ getfacl /project
getfacl: Removing leading '/' from absolute path names
# file: project
# owner: root
# group: Developers
user::rwx
user:nikhil:rwx
group::rwx
mask::rwx
other::---
```

```
Akshay@Akshay:~$ sudo -u nikhil bash -c 'ls -ld /project || echo "Access denied for Nikhil"'
drwxrwx---. 2 root Developers 4096 Nov  2 07:31 /project
Akshay@Akshay:~$ sudo setfacl -m u:nikhil:rwx /project
Akshay@Akshay:~$ getfacl /project
getfacl: Removing leading '/' from absolute path names
# file: project
# owner: root
# group: Developers
user::rwx
user:nikhil:rwx
group::rwx
mask::rwx
other::---

Akshay@Akshay:~$ sudo -u nikhil bash -c 'touch /project/nikhil_file && echo "nikhil was here" > /project/nikhil_file && ls -l /project'
total 8
-rw-rw-r--. 1 Ashu Ashu 16 Nov  2 07:31 Ashu_file
-rw-rw-r--. 1 nikhil nikhil 16 Nov  2 07:38 nikhil_file
Akshay@Akshay:~$ sudo setfacl -d -m g::rwx /project
Akshay@Akshay:~$ sudo -u Ashu bash -c 'touch /project/newfile && ls -l /project/newfile && getfacl /project/newfile'
-rw-rw----. 1 Ashu Ashu 0 Nov  2 07:42 /project/newfile
getfacl: Removing leading '/' from absolute path names
# file: project/newfile
# owner: Ashu
# group: Ashu
user::rw-
group::rw-
other::---

Akshay@Akshay:~$ sudo usermod -aG Testers Ashu
Akshay@Akshay:~$ id Ashu
uid=1006(Ashu) gid=1012(Ashu) groups=1012(Ashu),1009(Developers),1010(Testers)
Akshay@Akshay:~$ sudo gpasswd -d Ashu Developers
Removing user Ashu from group Developers
Akshay@Akshay:~$ sudo deluser nikhil
```



```
removing user nikhil from group developers
Akshay@Akshay:~$ sudo deluser nikhil
info: Removing crontab ...
info: Removing user 'nikhil' ...
Akshay@Akshay:~$ sudo groupdel Testers
Akshay@Akshay:~$ sudo groupdel Developers
Akshay@Akshay:~$ cat /etc/group
root:x:0:
daemon:x:1:
bin:x:2:
sys:x:3:
adm:x:4:syslog
tty:x:5:
disk:x:6:
lp:x:7:
mail:x:8:
news:x:9:
uucp:x:10:
man:x:12:
proxy:x:13:
kmem:x:15:
dialout:x:20:
fax:x:21:
voice:x:22:
cdrom:x:24:
floppy:x:25:
tape:x:26:
sudo:x:27:Akshay
audio:x:29:
dip:x:30:
www-data:x:33:
backup:x:34:
operator:x:37:
list:x:38:
irc:x:39:
src:x:40:
shadow:x:42:
```

```
Akshay:x:1000:
23BCA:x:1001:
Bca:x:1003:
student1:x:1005:
cgroup:x:1006:
teamgroup:x:1007:
ubuntu:x:1008:
Nikhil:x:1004:
Akshay1:x:1011:
Ashu:x:1012:
Akshay@Akshay:~$ sudo rm -rf /project
Akshay@Akshay:~$ ls -l /path/to/file
ls: cannot access '/path/to/file': No such file or directory
Akshay@Akshay:~$ ls -ld /project
ls: cannot access '/project': No such file or directory
Akshay@Akshay:~$ getfacl /project
getfacl: /project: No such file or directory
Akshay@Akshay:~$ getfacl /project/somefile
getfacl: /project/somefile: No such file or directory
Akshay@Akshay:~$ getent group Developers
Akshay@Akshay:~$ getent group Testers
Akshay@Akshay:~$ cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:bin:/bin:/usr/sbin/nologin
sys:x:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
```

```
gnome-terminal-setup.x.119.05554.,/run/gnome-terminal-setup/.0/0/race
gdm:x:120:121:Gnome Display Manager:/var/lib/gdm3:/bin/false
nm-openvpn:x:121:122:NetworkManager OpenVPN,,,:/var/lib/openvpn/chroot:/usr/sbin/nologin
Akshay:x:1000:1000:Akshay:/home/Akshay:/bin/bash
student1:x:1002:1005::/home/student1:/bin/sh
ubuntu:x:1003:1008::/home/ubuntu:/bin/sh
Nikhil:x:1004:1004::/home/Nikhil:/bin/sh
Akshay1:x:1005:1011::/home/Akshay1:/bin/sh
Ashu:x:1006:1012::/home/Ashu:/bin/bash
Akshay@Akshay:~$ history
 1  pwd
 2  sudo apt update
 3  sudo apt upgrade
 4  cd Akshay
 5  sudo groupadd 23BCA
 6  sudo group add 23BCA
 7  pwd
 8  mkdir Permission
 9  cd Permission
10  ls
11  cd ..
12  sudo useradd BCA23
13  mkdir new
14  cd new
15  ps
16  ps -e
17  top
18  sleep 10s
19  sleep 10s &
20  jobs
21  sudo apt update
22  sudo apt install selinux-basics selinux-policy-default auditd
23  sudo selinux-activate
24  sudo reboot
25  sudo apt update
26  sudo apt install -y acl
27  sudo groupadd Developers
```



```
27 sudo groupadd Developers
28 sudo groupadd Testers
29 cat /etc/group
30 sudo useradd Akshay
31 sudo useradd Akshay kumar
32 sudo useradd Nikhil
33 sudo useradd Akshay1
34 cat /etc/passwd
35 getent group Developers Testers
36 sudo useradd -m -s /bin/bash -G Developers Akshay1
37 sudo useradd -m -s /bin/bash -G Developers Ashu
38 sudo passwd Ashu
39 sudo useradd -m -s /bin/bash -G Testers nikhil
40 sudo passwd nikhil
41 id Ashu
42 id nikhil
43 sudo mkdir /project
44 sudo chown root:Developers /project
45 sudo chmod 770 /project
46 ls -ld /project
47 sudo -u Ashu bash -c 'touch /project/Ashu_file && echo "Hello from Ashu" > /project/Ashu_file && ls -l /project'
48 sudo -u nikhil bash -c 'ls -ld /project || echo "Access denied for Nikhil"'
49 sudo setfacl -m u:nikhil:rwx /project
50 getfacl /project
51 sudo -u nikhil bash -c 'touch /project/nikhil_file && echo "nikhil was here" > /project/nikhil_file && ls -l /project'
52 sudo setfacl -d -m g::rwx /project
53 sudo -u Ashu bash -c 'touch /project/newfile && ls -l /project/newfile && getfacl /project/newfile'
54 sudo usermod -aG Testers Ashu
55 id Ashu
56 sudo gpasswd -d Ashu Developers
57 sudo deluser nikhil
58 sudo groupdel Testers
59 sudo groupdel Developers
60 cat /etc/group
61 sudo rm -rf /project
62 ls -l /path/to/file
```

```
62 ls -l /path/to/file
63 ls -ld /project
64 getfacl /project
65 getfacl /project/somefile
66 getent group Developers
67 getent group Testers
68 cat /etc/passwd
69 history
```

Akshay@Akshay:~\$

## Conclusion:

Through this project, we successfully implemented Linux user and group management, set directory permissions, and configured ACLs for finegrained access control. By testing different access levels for Ashu and Nikhil, we verified that ACLs provide more flexibility than traditional permission systems.

## LEARNING OUTCOMES:

- Learned how to create and manage users and groups in Linux.
- Understood how to assign permissions using chmod, chown, and setfacl.
- Gained knowledge about Access Control Lists (ACLs) for fine-grained permission control.
- Practiced verifying permissions and ownership using ls -l and getfacl.
- Learned to add, modify, and delete users or groups effectively.
- Understood how to secure shared directories and manage access between users.

## Future Scope

1. Implement automated scripts for managing users and permissions efficiently.
2. Integrate role-based access control (RBAC) for larger systems.
3. Use LDAP or Active Directory for centralized user authentication.
4. Apply the same concepts in enterprise servers or cloud environments.
5. Add audit and logging tools to monitor permission changes and user activity.