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Creating Users and Groups/ Ownership and Permissions

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Input/Output Redirection

Input/Output (I/O) redirection allows for command line information to be passed to different streams. Before discussing redirection, it is important to understand the standard streams.

Input and output in the Linux environment is distributed across three streams. These streams are:

1. *STDIN*
   Standard input, or STDIN, is information entered normally by the user via the keyboard. When a command prompts the shell for data, the shell provides the user with the ability to type commands that, in turn, are sent to the command as STDIN.
2. *STDOUT*
   Standard output, or STDOUT, is the normal output of commands. When a command functions correctly (without errors) the output it produces is called STDOUT. By default, STDOUT is displayed in the terminal window where the command is executing. STDOUT is also known as stream or channel #1.
3. *STDERR*
   Standard error, or STDERR, is error messages generated by commands. By default, STDERR is displayed in the terminal window where the command is executing. STDERR is also known as stream or channel #2.

The redirection capabilities built into Linux provide you with a robust set of tools used to make all sorts of tasks easier to accomplish. Whether you're writing complex software or performing file management through the command line, knowing how to manipulate the different I/O streams in your environment will greatly increase your productivity.

I/O redirection allows the user to redirect STDIN so that data comes from a file and STDOUT/STDERR so that output goes to a file. Redirection is achieved by using the arrow < > characters.

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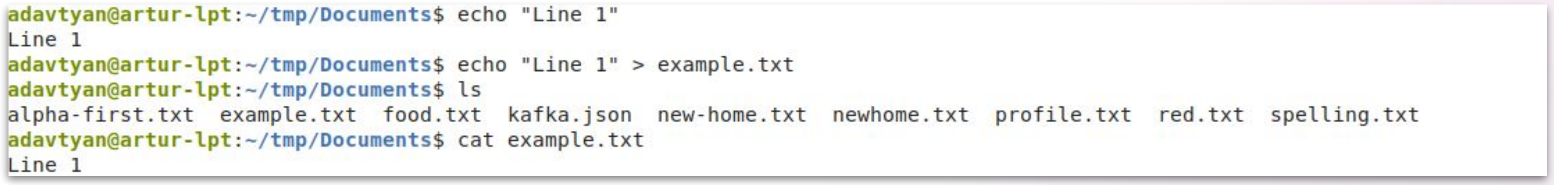
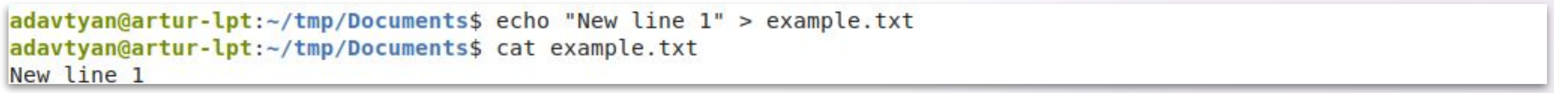
STDOUT

STDOUT can be directed to files. To begin, observe the output of the following echo command which displays to the screen and Using the > character, the output can be redirected to a file instead:



```
adavtyan@artur-lpt:~/tmp/Documents$ echo "Line 1"
Line 1
adavtyan@artur-lpt:~/tmp/Documents$ echo "Line 1" > example.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls
alpha-first.txt  example.txt  food.txt  kafka.json  new-home.txt  newhome.txt  profile.txt  red.txt  spelling.txt
adavtyan@artur-lpt:~/tmp/Documents$ cat example.txt
Line 1
```

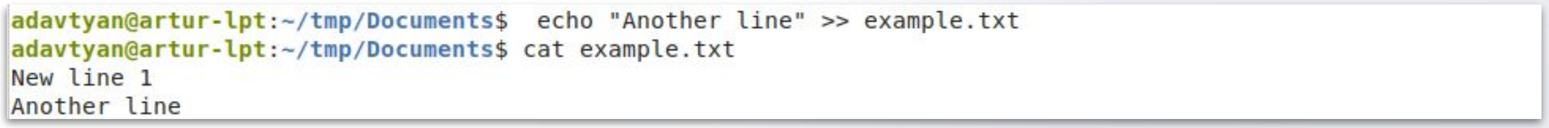
It is important to realize that the single arrow overwrites any contents of an existing file:



```
adavtyan@artur-lpt:~/tmp/Documents$ echo "New line 1" > example.txt
adavtyan@artur-lpt:~/tmp/Documents$ cat example.txt
New line 1
```

The original contents of the file are gone, replaced with the output of the new echo command.

It is also possible to preserve the contents of an existing file by appending to it. Use two arrow >> characters to append to a file instead of overwriting it:



```
adavtyan@artur-lpt:~/tmp/Documents$  echo "Another line" >> example.txt
adavtyan@artur-lpt:~/tmp/Documents$ cat example.txt
New line 1
Another line
```

Instead of being overwritten, the output of the echo command is added to the bottom of the file.

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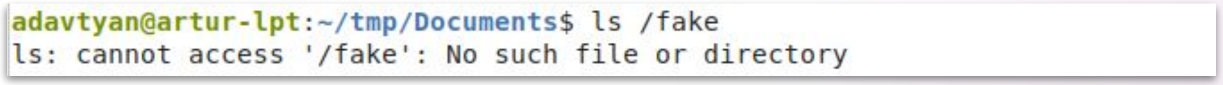
STDERR

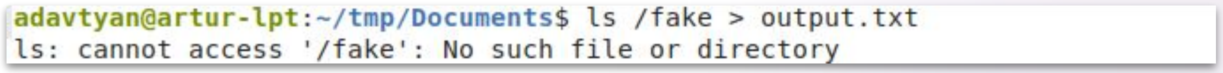
STDERR can be redirected similarly to STDOUT. When using the arrow character to redirect, stream #1 (STDOUT) is assumed unless another stream is specified. Thus, stream #2 must be specified when redirecting STDERR by placing the number 2 preceding the arrow > character.

To demonstrate redirecting STDERR, first observe the following command which produces an error because the specified directory does not exist:



```
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake
ls: cannot access '/fake': No such file or directory
```

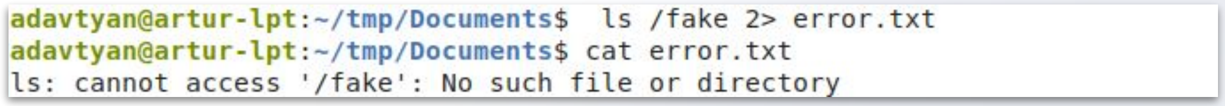
Note that there is nothing in the example above that implies that the output is STDERR. The output is clearly an error message, but how could you tell that it is being sent to STDERR? One easy way to determine this is to redirect STDOUT:



```
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake > output.txt
ls: cannot access '/fake': No such file or directory
```

In the example above, STDOUT was redirected to the output.txt file. So, the output that is displayed can't be STDOUT because it would have been placed in the output.txt file instead of the terminal. Because all command output goes either to STDOUT or STDERR, the output displayed above must be STDERR.

The STDERR output of a command can be sent to a file:



```
adavtyan@artur-lpt:~/tmp/Documents$  ls /fake 2> error.txt
adavtyan@artur-lpt:~/tmp/Documents$ cat error.txt
ls: cannot access '/fake': No such file or directory
```

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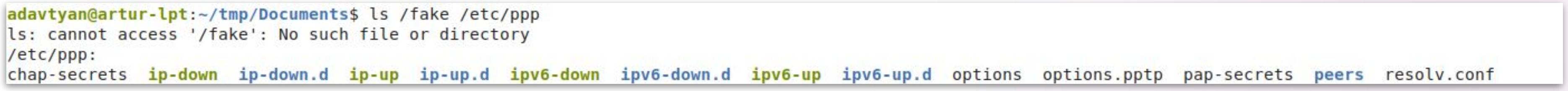
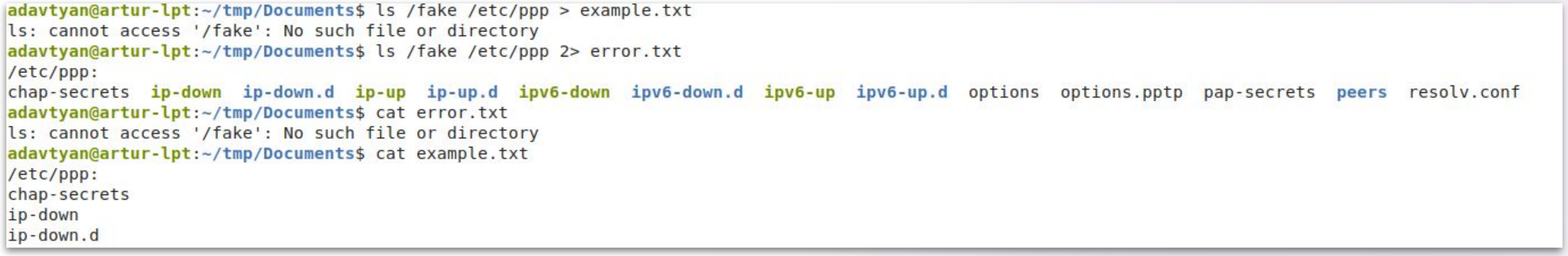
Redirecting Multiple Streams

It is possible to direct both the STDOUT and STDERR of a command at the same time. The following command produces both STDOUT and STDERR because one of the specified directories exists and the other does not:



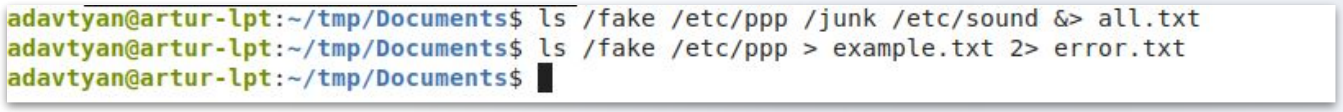
```
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake /etc/ppp
ls: cannot access '/fake': No such file or directory
/etc/ppp:
chap-secrets  ip-down  ip-down.d  ip-up  ip-up.d  ipv6-down  ipv6-down.d  ipv6-up  ipv6-up.d  options  options.pptp  pap-secrets  peers  resolv.conf
```

If only the STDOUT is sent to a file, STDERR is still printed to the screen and If only the STDERR is sent to a file, STDOUT is still printed to the screen:



```
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake /etc/ppp > example.txt
ls: cannot access '/fake': No such file or directory
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake /etc/ppp 2> error.txt
/etc/ppp:
chap-secrets  ip-down  ip-down.d  ip-up  ip-up.d  ipv6-down  ipv6-down.d  ipv6-up  ipv6-up.d  options  options.pptp  pap-secrets  peers  resolv.conf
adavtyan@artur-lpt:~/tmp/Documents$ cat error.txt
ls: cannot access '/fake': No such file or directory
adavtyan@artur-lpt:~/tmp/Documents$ cat example.txt
/etc/ppp:
chap-secrets
ip-down
ip-down.d
```

Both STDOUT and STDERR can be sent to a file by using the ampersand & character in front of the arrow > character. The &> character set means both 1> and 2> or If you don't want STDERR and STDOUT to both go to the same file, they can be redirected to different files by using both > and 2>. For example, to direct STDOUT to example.txt and STDERR to error.txt execute the following:



```
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake /etc/ppp /junk /etc/sound &> all.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls /fake /etc/ppp > example.txt 2> error.txt
adavtyan@artur-lpt:~/tmp/Documents$ █
```

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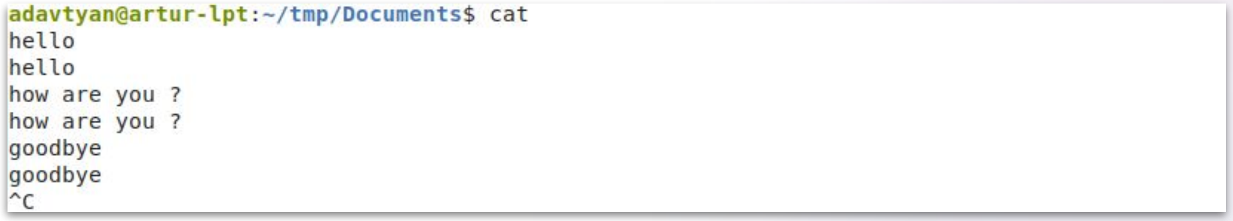
STDINN

The concept of redirecting STDIN is a difficult one because it is more difficult to understand why you would want to redirect STDIN. With STDOUT and STDERR, their purpose is straightforward; sometimes it is helpful to store the output into a file for future use.

Most Linux users end up redirecting STDOUT routinely, STDERR on occasion, and STDIN very rarely.

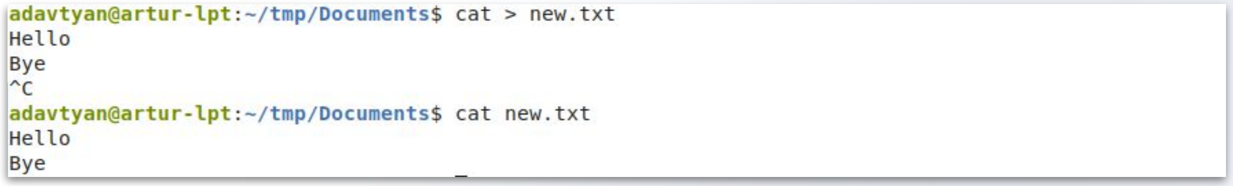
There are very few commands that require you to redirect STDIN because with most commands if you want to read data from a file into a command, you can specify the filename as an argument to the command.

For some commands, if you don't specify a filename as an argument, they revert to using STDIN to get data. For example, consider the following cat command:



```
adavtyan@artur-lpt:~/tmp/Documents$ cat
hello
hello
how are you ?
how are you ?
goodbye
goodbye
^C
```

The first command in the example below redirects the output of the cat command to a newly created file called new.txt. This action is followed up by providing the cat command with the *new.txt* file as an argument to display the redirected text in STDOUT.



```
adavtyan@artur-lpt:~/tmp/Documents$ cat > new.txt
Hello
Bye
^C
adavtyan@artur-lpt:~/tmp/Documents$ cat new.txt
Hello
Bye
```

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Permissions

The output of the ls -l command displays ten characters at the beginning of each line. These characters indicate the type of file and the permissions of the file. For example, consider the output of the following command: ***“ls -l /etc/passwd”***

```
-rw-r--r-- 1 root root 2951 Մայ  6 18:13 /etc/passwd
```

File Type

The first character of each line indicates the type of file:

The following table describes the possible values for the file type:

Character	Type of the File
-	A regular file, which may be empty, or contain text or binary data.
d	A directory file, which contains the names of other files and links to them.
l	A symbolic link is a file name that refers (points) to another file.
b	A block file is one that relates to a block hardware device where data is read in blocks of data.
c	A character file is one that relates to a character hardware device where data is read one byte at a time.
p	A pipe file works similar to the pipe symbol, allowing for the output of one process to communicate to another process through the pipe file, where the output of the one process is used as input for the other process.
s	A socket file allows two processes to communicate, where both processes are allowed to either send or receive data.

Permission Groups

The next nine characters demonstrate the permissions of the file.

```
-rw-r--r-- 1 root root 2951 Մայ  6 18:13 /etc/passwd
```

The permissions set on these files determine the level of access that a user has on the file. When a user runs a program and the program accesses a file, then the permissions are checked to determine whether the user has the correct access rights to the file.

The permissions are grouped into three different roles, representing the different users that may try to access the file. If you aren't the owner and you're not a member of the file/directory group, then your permissions would be others.

User Owner: Characters 2-4 indicate the permissions for the user that owns the file. If you are the owner of the file, then only the user owner permissions are used to determine access to that file.

```
-rw-r--r-- 1 root root 2951 Մայ  6 18:13 /etc/passwd
```

Group Owner: Characters 5-7 indicate the permissions for the group that owns the file. If you are not the owner but are a member of the group that owns the file, then only group owner permissions are used to determine access to that file.

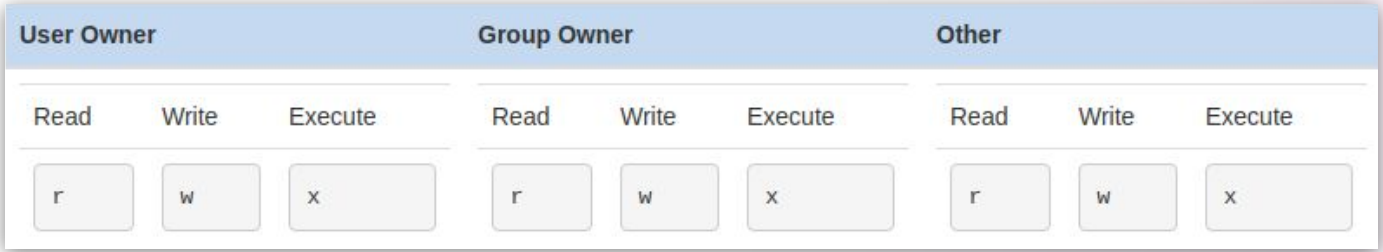
```
-rw-r--r-- 1 root root 2951 Մայ  6 18:13 /etc/passwd
```

Other Permissions: Characters 8-10 indicate the permissions for others or what is sometimes referred to as the world's permissions. This group includes all users who are not the file owner or a member of the file's group.

```
-rw-r--r-- 1 root root 2951 Մայ  6 18:13 /etc/passwd
```

Permission Type

Each group is attributed three basic types of permissions: read, write, and execute.



User Owner			Group Owner			Other		
Read	Write	Execute	Read	Write	Execute	Read	Write	Execute
r	w	x	r	w	x	r	w	x

Read

The first character of each group represents the read permission. There is an r character if the group has the read permission, or a - character if the group does not.

- On a file, this allows processes to read the contents of the file, meaning the contents can be viewed and copied.
- On a directory, file names in the directory can be listed, but other details are not available.

Write

The second character of each group represents the write permission. There is a w character if the group has the write permission, or a - character if the group does not.

- A file can be written to by the process, so changes to a file can be saved. Note that w permission really requires r permission on the file to work correctly.
- On a directory, files can be added to or removed from the directory. Note that w permission requires x permission on the directory to work correctly.

Execute

The third character of each group represents the execute permission. There is an x character if the group has the execute permission, or a - character if the group does not.

- A file can be executed or run as a process.
- On a directory, the user can use the cd command to "get into" the directory and use the directory in a pathname to access files and, potentially, subdirectories under this directory.

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Symbolic Method

The chmod (change mode) command is used to change permissions on files and directories. There are two techniques that can be used with this command: symbolic and numeric. Both techniques use the following basic syntax:

```
chmod   new_permission   file_name
```

Symbolic Method: If you want to modify some of the current permissions, the symbolic method is usually easier to use. With this method, you specify which permissions you want to change on the file, and the other permissions remain as they are. When specifying the *new_permission* argument of the *chmod* command using the symbolic method three types of information are required.

Start by using one or more of the following characters to indicate which permission group(s) to apply the changes to:

u	user owner
g	group owner
o	others
a	all (user owner, group owner, and others)

Then choose one of the following operators to indicate how to modify the permissions:

+	add
-	remove
=	equals

Lastly, use the following characters to specify the permissions type(s) to change:

r	read
w	write
e	execute

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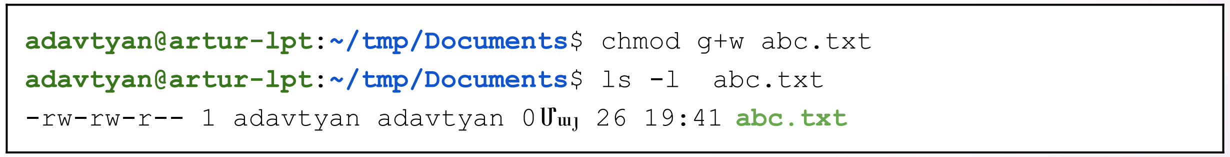
Symbolic Method

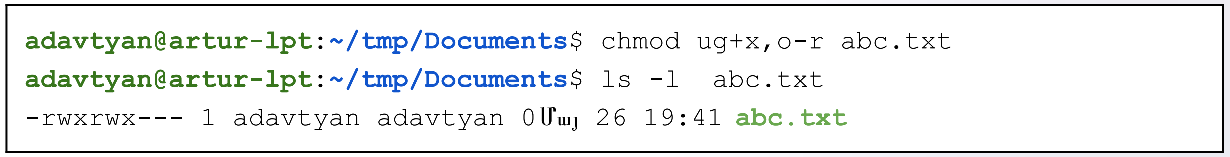
For example, to give the group owner write permission on a file named abc.txt, you could use the following command:



```
adavtyan@artur-lpt:~/tmp/Documents$ chmod g+w abc.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls -l  abc.txt
-rw-rw-r-- 1 adavtyan adavtyan 0 Մայ 26 19:41 abc.txt
```

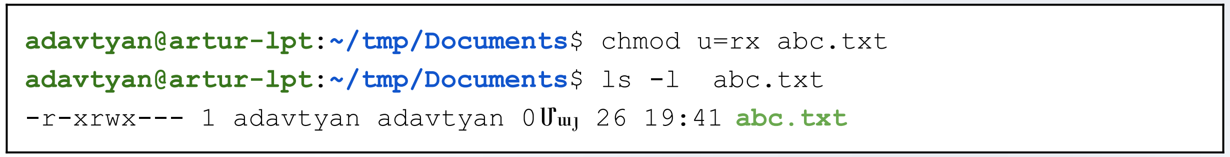
Only the group owner's permission was changed. All other permissions remained as they were prior to the execution of the chmod command. You can combine values to make multiple changes to the file's permissions.

For example, consider the following command which adds the execute permission to the user owner and group owner and removes the read permission for others:



```
adavtyan@artur-lpt:~/tmp/Documents$ chmod ug+x,o-r abc.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls -l  abc.txt
-rwxrwx--- 1 adavtyan adavtyan 0 Մայ 26 19:41 abc.txt
```

Lastly, you could use the = character, which adds specified permissions and causes unmentioned ones to be removed. For example, to give the user owner only read and execute permissions, removing the write permission:



```
adavtyan@artur-lpt:~/tmp/Documents$ chmod u=rx abc.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls -l  abc.txt
-r-xrwx--- 1 adavtyan adavtyan 0 Մայ 26 19:41 abc.txt
```

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Numeric Method

The numeric method (also called the octal method) is useful when changing many permissions on a file. It is based on the octal numbering system in which each permission type is assigned a numeric value:

4	read
2	write
1	execute

By using a combination of numbers from 0 to 7, any possible combination of read, write and execute permissions can be specified for a single permission group set. For example:

7	rwx		3	-wx
6	rw-		2	-w-
5	r-x		1	--x
4	r--		0	---

The new_permission argument is specified as three numbers, one number for each permission group. When the *numeric method* is used to change permissions, all nine permissions must be specified. Because of this, the symbolic method is generally easier for changing a few permissions while the numeric method is better for changes that are more drastic.

For example, to set the permissions of a file named *abc.txt* to be *rwxr-xr--* you could use the following command:

```
adavtyan@artur-lpt:~/tmp/Documents$ chmod 754 abc.txt
adavtyan@artur-lpt:~/tmp/Documents$ ls -l  abc.txt
-rwxr-xr-- 1 adavtyan adavtyan 0Մայ 26 19:41 abc.txt
```

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Default Permissions

The umask command is a feature that is used to determine default permissions that are set when a file or directory is created. Default permissions are determined when the umask value is subtracted from the maximum allowable default permissions. The maximum default permissions are different for files and directories:

file	rw-rw-rw-
directories	rwxrwxrwx

The permissions that are initially set on a file when it is created cannot exceed rw-rw-rw-. To have the execute permission set on a file, you first need to create the file and then change the permissions.

The umask command can be used to display the current umask value:

```
adavtyan@artur-lpt:~/tmp/Documents$ umask
0002
```

A breakdown of the output:

- The first 0 indicates that the umask is given as an octal number.
- The second 0 indicates which permissions to subtract from the default user owner's permissions.
- The third 0 indicates which permissions to subtract from the default group owner's permissions.
- The last number 2 indicates which permissions to subtract from the default other's permissions.

```
adavtyan@artur-lpt:~/tmp/Documents$ sudo su
root@artur-lpt:/home/adavtyan/tmp/Documents$ umask
0022
```

Note that different users may have different umasks. Typically the root user has a more restrictive umask than normal user accounts:

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Default Permissions

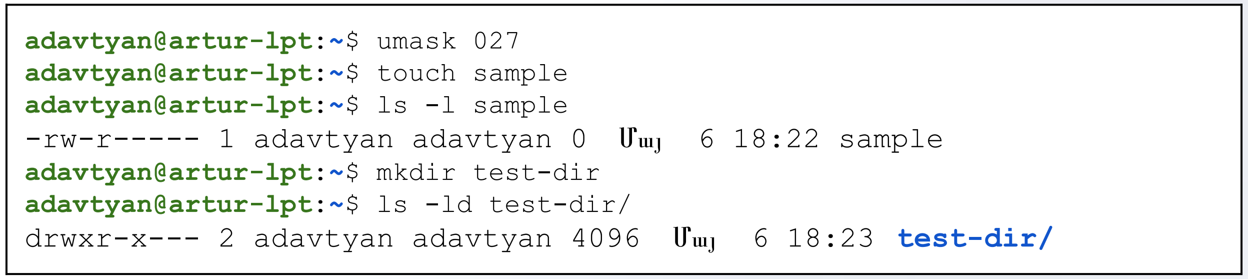
To understand how umask works, assume that the umask of a file is set to 027 and consider the following:

File Default	666	
Umask	-027	
Result	640	rw-r-----

Because the default permissions for directories are different than for files, a umask of 027 would result in different initial permissions on new directories:

Directory Default	777	
Umask	-027	
Result	750	rwxr-x---

Example:



```
adavtyan@artur-lpt:~$ umask 027
adavtyan@artur-lpt:~$ touch sample
adavtyan@artur-lpt:~$ ls -l sample
-rw-r----- 1 adavtyan adavtyan 0  Մայ  6 18:22 sample
adavtyan@artur-lpt:~$ mkdir test-dir
adavtyan@artur-lpt:~$ ls -ld test-dir/
drwxr-x--- 2 adavtyan adavtyan 4096  Մայ  6 18:23 test-dir/
```

The new umask is only applied to file and directories created during that session. When a new shell is started, the default umask will again be in effect. Permanently changing a user's umask requires modifying the .bashrc file located in that user's home directory.

Groups

The most common reason to create a group is to provide a way for users to share files. For example, if several people who work together on the same project and need to be able to collaborate on documents stored in files for the project. In this scenario, the administrator can make these people members of a common group, change the directory ownership to the new group and set permissions on the directory that allows members of the group to access the files.

After creating or modifying a group, you can verify the changes by viewing the group configuration information in the /etc/group file with the grep command. If working with network-based authentication services, then the getent command can show you both local and network-based groups.

For local usage, these commands show the same result, in this case for the root group:

```
adavtyan@artur-lpt:~$ sudo grep root /etc/group
root:x:0:
adavtyan@artur-lpt:~$ getent group root
root:x:0:
```

The groupadd command can be executed by the root user to create a new group. The command requires only the name of the group to be created. The -g option can be used to specify a group id for the new group:

```
adavtyan@artur-lpt:~$
adavtyan@artur-lpt:~$ sudo groupadd -g 1100 researcher
adavtyan@artur-lpt:~$ sudo grep researcher /etc/group
researcher:x:1100:
```

If the -g option is not provided, the groupadd command will automatically provide a GID for the new group. To accomplish this, the groupadd command looks at the /etc/group file and uses a number that is one value higher than the current highest GID number.

Modifying a Group

The groupmod command can be used to either change the name of a group with the -n option or change the GID for the group with the -g option. Changing the name of the group may confuse users who were familiar with the old name and haven't been informed of the new name. However, changing the group name won't cause any problems with accessing files, since the files are owned by GIDs, not group names.

For example:

```
adavtyan@artur-lpt:~$ ls -ls index.html
-rw-rw-r-- 1 adavtyan research 0  Մայ  6 18:13 index.html
adavtyan@artur-lpt:~$ sudo groupmod -n researcher research
adavtyan@artur-lpt:~$ ls -ls index.html
-rw-rw-r-- 1 adavtyan researcher 0  Մայ  6 18:13 index.html
```

After the previous groupmod command, the index.html file has a different group owner name. On the other hand, if you change the GID for a group, then all files that were associated with that group will no longer be associated with that group. In fact, all files that were associated with that group will no longer be associated with any group name. Instead, these files will be owned by a GID only, as shown below:

```
adavtyan@artur-lpt:~$ sudo groupmod -g 1101 researcher
adavtyan@artur-lpt:~$ ls -ls index.html
-rw-rw-r-- 1 adavtyan 1100 0  Մայ  6 18:13 index.html
```

If you decide to delete a group with the groupdel command, be aware that any files that are owned by that group will become orphaned. Only supplemental groups can be deleted, so if any group that is the primary group for any user, it cannot be deleted. The administrator can modify which group is a user's primary group, so a group that was being used as a primary group can be made into a supplemental group and then can be deleted.

Users

User account information is stored in the /etc/passwd file and user authentication information (password data) is stored in the /etc/shadow file. Creating a new user can be accomplished by manually adding a new line to each of these files, but that is generally not the recommended technique.

By using an appropriate command to add a new user, these files can be modified automatically and safely. If you were to modify these files manually, you would risk making a mistake that could prevent all users from being able to log in normally.

Before you begin creating users for your system, you should verify or establish practical values that are used by default with the useradd command. These settings can be found in the configuration files that are used by the useradd command.

Ensuring that the values in these configuration files are reasonable before adding users can help save you the time and trouble of having to correct user account settings after adding the users.

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Account Considerations

Creating a user account for use with a Linux system may require that you gather several pieces of information. While all that may be required is the account name, you may also want to plan the UID, the primary group, the supplementary groups, the home directory, the skeleton directory, and the shell to be used. When planning these values, consider the following:

***Username*:** The only required argument for the useradd command is the name you want the account to have. The username should follow the same guidelines as for group names. Following these guidelines can help you to select a username that is portable:

The first character of the name should be either an underscore "_" character or a lower-case alphabetic a-z character. Up to 32 characters are allowed on most Linux distributions, but using more than 16 can be problematic as some distributions may not accept more than 16. After the first character, the remaining characters can be alphanumeric, a dash "-" character or an underscore "_" character. The last character should not be a hyphen "-" character.

If the user needs to access multiple systems, it is usually recommended to have the account name be the same on those systems. The account name must be unique for each user.

```
adavtyan@artur-lpt:~$
adavtyan@artur-lpt:~$ sudo useradd anna
```

User Identifier (UID): Once you create a user with a specific UID, the system generally increments the UID by one for the next user that you create. If attached to a network with other systems, you may want to ensure that this UID is the same on all systems to help provide consistent access.

Adding the -u option to the useradd command allows you to specify the UID number. UIDs typically can range anywhere from zero to over four billion, but for greatest compatibility with older systems, the maximum recommended UID value is 60,000.

```
adavtyan@artur-lpt:~$
adavtyan@artur-lpt:~$ sudo useradd -u 1100 anna
```

Account Considerations

The root user has a UID of 0, which allows that account to have special privileges. Any account with a UID of 0 would effectively be able to act as the administrator.

System accounts are generally used to run background services called daemons. By not having services run as the root user, the amount of damage that can be done with a compromised service account is limited. System accounts used by services generally use UIDs that are in the reserved range. One system account that is an exception to this rule is the user nfsnobody, which has a UID of 65534.

The reserved range used for service accounts has expanded over time. Initially, it was for UIDs between 1 and 99. Then, it expanded to be between 1 and 499. The current trend among distributions is that system accounts are any account that has a UID between 1 and 999, but the range 1-499 is also still commonly used.

When setting up a new system, it is a good practice to start UIDs no lower than 1000 ensuring there are sufficient UIDs available for many system services and giving you the ability to create many GIDs in the reserved range.

Primary Group: In distributions which feature UPG, this group is created automatically with a GID and group name that matches the UID and username of the newly created user account. In distributions not using UPG, the primary group ordinarily defaults to the users group with a GID of 100.

To specify a primary group with the useradd command, use the -g option with either the name or GID of the group. For example, to specify users as the primary group:

```
adavtyan@artur-lpt:~$
adavtyan@artur-lpt:~$ sudo useradd -g users
```

sourcemind

Account Considerations

Supplementary Group: To make the user a member of one or more supplementary groups, the -G option can be used to specify a comma-separated list of group names or numbers. For example to specify sales and research as supplementary groups:

```
adavtyan@artur-lpt:~$
adavtyan@artur-lpt:~$ sudo useradd -G developer,research
```

Home Directory: By default, most distributions create the user's home directory with the same name as the user account underneath whichever base directory is specified in the HOME setting of the /etc/default/useradd file, which typically specifies the /home directory. For example, if creating a user account named jane, the user's new home directory would be /home/anna.

```
adavtyan@artur-lpt:~$ grep '/home/anna' /etc/passwd
anna:x:1001:1001:: /home/anna:/bin/sh
```

There are several options for the useradd command that can affect creating the user's home directory

- If CREATE_HOME is set to no or this setting is not present, then the directory will not be created automatically. Otherwise, the -M option is used to specify to the useradd command that it should not create the home directory, even if CREATE_HOME is set to yes.
- If the CREATE_HOME setting in the /etc/login.defs file is set to yes, the home directory is created automatically. Otherwise, the -m option can be used to make the home directory.
- The -b option allows you to specify a different base directory under which the user's home directory is created.
- The -d option allows you to specify either an existing directory or a new home directory to create for the user. This should be a full path for the user's home directory.
- The -k option to specifies a different skeleton directory. When using the -k option, the -m option is required.

```
adavtyan@artur-lpt:~$ sudo useradd -m anna
adavtyan@artur-lpt:~$ ls -ld /home/anna
drw-r-xr-x 2 anna anna 4096 Մայ  6 18:13 /home/anna
```

sourcemind

Account Considerations

Skeleton Directory

By default, the contents of the /etc/skel directory are copied into the new user's home directory. The resulting files are also owned by the new user. By using the -k option with the useradd command, the contents of a different directory can be used to populate a new user's home directory. When specifying the skeleton directory with the -k option, the -m option must be used or else the useradd command will fail with an error.

The following example uses /home/sysadmin as the skeleton directory:

```
adavtyan@artur-lpt:~$ sudo useradd -mk /home/sysadmin jane
adavtyan@artur-lpt:~$ sudo ls /home/jane
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
```

Shell

While the default shell is specified in the /etc/default/useradd file, it can also be overridden with the useradd command using the -s option at the time of account creation:

```
adavtyan@artur-lpt:~$ sudo useradd -s /bin/bash jane
```

It is common to specify the /sbin/nologin shell for accounts to be used as system accounts.

Comment

The comment field, originally called the General Electric Comprehensive Operating System (GECOS) field, is typically used to hold the user's full name. Many graphical login programs display this field's value instead of the account name. The -c option of the useradd command allows for the value of this field to be specified.

```
adavtyan@artur-lpt:~# sudo useradd -c ‘Anna Stepanyan’ /bin/bash anna
```

sourcemind

Creating a User

Once you've verified which default values to use and you've gathered the information about the user, then you are ready to create a user account. An example of a useradd command using a few options looks like the following:

```
root@artur-lpt:~# useradd -u 1009 -g users -G sales,research -mc 'Jane' jane
```

This example of the useradd command creates a user with a UID of 1009, a primary group of users, supplementary memberships in the sales and research groups, a comment of "Jane Doe", and an account name of jane.

After executing the previous command, the information about the jane user account is automatically added to the /etc/passwd and /etc/shadow files, while the information about supplemental group access is automatically added to the /etc/group file:

```
root@artur-lpt:~# grep jane /etc/passwd
jane:x:1009:100:Jane Doe:/home/jane:/bin/sh
root@artur-lpt:~# grep jane /etc/shadow
jane:!:17883:0:99999:7:30::
root@artur-lpt:~# grep jane /etc/group
research:x:1005:jane
sales:x:999:jane
```

In addition, if the CREATE_MAIL_SPOOL is set to yes then the mail spool file /var/spool/mail/jane is created:

```
root@artur-lpt:~# ls /var/spool/mail
jane root rpc sysadmin
```

sourcemind

Passwords

Choosing a good password is not an easy task, but it is critical that it is done properly or the security of an account (perhaps the entire system) could be compromised. Picking a good password is only a start; you need to be very careful with your password so that it is not revealed to other people. You should never tell anyone your password and never let anyone see you type your password. If you do choose to write down your password, then you should store it securely in a place like a safe or safe deposit box.

There are numerous factors to consider when you are trying to choose a password for an account:

- **Length**: The /etc/login.defs file allows the administrator to specify the minimum length of the password. While some believe that the longer the password, the better, this isn't really correct. The problem with passwords that are too long is that they are not easily remembered and, as a result, they are often written down in a place where they can easily be found and compromised.
- **Composition**: A good password should be composed of a combination of alphabetic, numeric and symbolic characters.
- **Lifetime**: The maximum amount of time that a password can be used should be limited for several reasons:
  - If an account is compromised and the time that the password is valid is limited, the intruder will ultimately lose access when the password becomes invalid.
  - If an account is not being used, then it can automatically be disabled when the password is no longer valid.
  - If attackers are attempting a "brute-force" attack by trying every possible password, then the password can be changed before the attack can succeed

Opinions vary about how often users should be forced to change their passwords. For highly-sensitive accounts, it is recommended to change passwords more frequently, such as every 30 days. On the other hand, for non-critical accounts without any access to sensitive information, there is less need for frequent change. For accounts with minimal risk, having a duration of 90 days would be considered more reasonable.

sourcemind

Setting a User Password

There are several ways for a user password to be changed. The user can execute the passwd command, the administrator can execute the passwd command providing the username as an argument, or graphical tools are also available.

The administrator can use the passwd command to either set the initial password or change the password for the account. For example, if the administrator had created the account jane, then executing passwd jane provides the administrator a prompt to set the password for the jane account. If completed successfully, then the /etc/shadow file will be updated with the user's new password.

While regular users must follow many password rules, the root user only needs to follow one rule: the password cannot be left blank. When the root user violates all other password rules that normally apply to regular users, it results in a warning being printed to the screen and the rule not being enforced:

```
root@artur-lpt:~# passwd jane
Enter new UNIX password:
BAD PASSWORD: it is WAY to short
BAD PASSWORD: is too simple
Retype new UNIX password:
```

Assuming that the administrator has set a password for a user account, the user can then log in with that account name and password. After the user opens a terminal, they can execute the passwd command with no arguments to change their own password. They are prompted for their current password and then prompted to enter the new password twice.

Using the privileges of the root user, the encrypted passwords and other password-related information can be viewed by viewing the /etc/shadow file. Recall that regular users cannot see the contents of this file.

Modifying User

The usermod command offers many options for modifying an existing user account. Many of these options are also available with the useradd command at the time the account is created. The following chart provides a summary of the usermod options:

Several of these options are worthy of discussion because of how they impact user management. It can be very problematic to change the user's UID with the -u option, as any files owned by the user will be orphaned. On the other hand, specifying a new login name for the user with -l does not cause the files to be orphaned.

Deleting a user with the userdel command can either orphan or remove the user's files on the system. Instead of deleting the account, another choice is to lock the account with the -L option for the usermod command. Locking an account prevents the account from being used, but ownership of the files remains.

There are some important things to know about managing the supplementary groups. If you use the -G option without the -a option, then you must list all the groups to which the user would belong. Using the -G option alone can lead to accidentally removing a user from all the former supplemental groups that the user belonged to.

If you use the -a option with -G then you only have to list the new groups to which the user would belong. For example, if the user jane currently belongs to the sales and research groups, then to add her account to the development group, execute the following command:

```
adavtyan@artur-lpt:~$ sudo su -
root@artur-lpt:~# usermod -a -G development jane
root@artur-lpt:~# id jane
uid=1001(jane) gid=1001(jane) groups=1001(jane),1100(development)
```

sourcemind

Deleting User

The userdel command is used to delete users. When you delete a user account, you also need to decide whether to delete the user's home directory. The user's files may be important to the organization, and there may even be legal requirements to keep the data for a certain amount of time, so be careful not to make this decision lightly. Also, unless you've made backup copies of the data, once you've executed the command to delete the user and their files, there is no reversing the action.

To delete the user jane without deleting the user's home directory /home/jane, execute:

```
root@artur-lpt:~#
root@artur-lpt:~# userdel jane
root@artur-lpt:~#
```

Beware that deleting a user without deleting their home directory means that the user's home directory files will be orphaned and these files will be owned solely by their former UID and GID.

To delete the user, home directory, and mail spool as well, use the -r option:

```
root@artur-lpt:~#
root@artur-lpt:~# userdel -r jane
root@artur-lpt:~#
```

sourcemind

File Ownership

By default, users own the files that they create. While this ownership can be changed, this function requires administrative privileges. Although most commands usually show the user owner as a name, the operating system is associating the user ownership with the UID for that username.

Every file also has a group owner. By default, the primary group of the user who creates the file is the group owner of any new files. Users are allowed to change the group owner of files they own to any group that they belong to. Similar to user ownership, the association of a file with a group is not done internally by the operating system by name, but by the GID of the group.

Since ownership is determined by the UID and GID associated with a file, changing the UID of a user (or deleting the user) has the effect of making a file that was originally owned by that user have no real user owner. When there is no UID in the /etc/passwd file that matches the UID of the owner of the file, then the UID (the number) is displayed as the user owner of the file instead of the username (which no longer exists). The same occurs for groups.

The id command can be useful for verifying which user account you are using and which groups you have available to use. By viewing the output of this command, you can see the user's identity information expressed both as a number and as a name.

The output of the id command displays the UID and user account name of the current user followed by the GID and group name of the primary group and the GIDs and group names of all group memberships:

```
adavtyan@artur-lpt:~$ id
uid=1000(adavtyan) gid=1000(adavtyan) groups=1000(adavtyan),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),116(lpadmin),999(docker)
```

The above example shows the user has a UID of 1000 for the user account sysadmin. It also shows that the primary group for this user has a GID of 1000 for the group sysadmin.

sourcemind

Changing Groups

If you know that the file you are about to create should belong to a group different from your current primary group, then you can use the newgrp command to change your current primary group.

```
newgrp group_name
```

The id command lists your identity information, including your group memberships. If you are only interested in knowing what groups you belong to, then you can execute the groups command:

```
adavtyan@artur-lpt:~$ groups
adavtyan adm cdrom sudo dip plugdev lpadmin docker
```

The output of the groups command may not be as detailed as the output of the id command, but if all you need to know is what groups you can switch to by using the newgrp command, then the groups command provides the information that you need. The id command output does show your current primary group, so it is useful for verifying that the newgrp command succeeded.

```
adavtyan@artur-lpt:~$ newgrp sudo
adavtyan@artur-lpt:~$ id
uid=1000(adavtyan) gid=27(sudo) groups=,4(adm),24(cdrom),30(dip),46(plugdev),116(lpadmin),999(docker),1000(adavtyan)
adavtyan@artur-lpt:~$ touch /tmp/filetest
adavtyan@artur-lpt:~$ ls -l /tmp/filetest
-rw-rw-r-- 1 adavtyan sudo 0 Մայ 26 17:46 /tmp/filetest
adavtyan@artur-lpt:~$
```

The newgrp command opens a new shell; as long as the user stays in that shell, the primary group won't change. To switch the primary group back to the original, the user can leave the new shell by running the exit command.

Changing Group and User Ownership

To change the group owner of an existing file the chgrp command can be used.

```
chgrp group_name file
```

As the root user, the chgrp command can be used to change the group owner of any file to any group. As a user without administrative privileges, the chgrp command can only be used to change the group owner of a file to a group that the user is already a member of:

To change the group ownership of all of the files of a directory structure, use the recursive -R option to the chgrp command. For example, the command in the following example would change the group ownership of the test_dir directory and all files and subdirectories of the test_dir directory.

```
chgrp -R group_name directory
```

The chown command allows the root user to change the user ownership of files and directories. A regular user cannot use this command to change the user owner of a file, even to give the ownership of one of their own files to another user. However, the chown command also permits changing group ownership, which can be accomplished by either root or the owner of the file. There are three different ways the chown command can be executed.

- The first method is used to change just the user owner of the file.
- The second method is to change both the user and the group; this also requires root privileges. To accomplish this, you separate the user and group by either a colon or a period character.
- If a user doesn't have root privileges, they can use the third method to change the group owner of a file just like the chgrp command. To use chown only to change the group ownership of the file, use a colon or a period as a prefix to the group name:

```
chown user /path/to/file

chown user:group /path/to/file

chown .group /path/to/file
```

sourcemind

Linux Services

A service is a program that runs in the background outside the interactive control of system users as they lack an interface. This in order to provide even more security, because some of these services are crucial for the operation of the operating system.

We can list all services in Linux

```
adavtyan@artur-lpt:~$ sudo systemctl list-unit-files --type service --all
```

When the command is run, we will see all the services that are on the system. However, we will also see that some have a defined status. Let's learn what all these mean.

- **Enabled** services are currently running. They usually have no problems.
- **Disabled** services are not active but can be activated at any time without a problem.
- **Masked** services won't run unless we take that property away from them.
- **Static** services will only be used in case another service or unit needs it.
- Finally, there are services **generated** through a SysV or LSB initscript with systemd generator.

In case we want to know only the services that are active, we have to use a command together with **grep**, like so:

```
adavtyan@artur-lpt:~$ sudo systemctl | grep running
```

sourcemind

Managing Linux Services

Now it is time to learn how to manage a specific service. Note that each service represents software that works differently. In this tutorial, we will only show how to start, check the status of and stop services – the basic controls

To start a service on Linux, we need to run the following command:

```
adavtyan@artur-lpt:~$ sudo systemctl start [service_name]
```

If the service is correctly configured, it will start. Now, if we want to stop it, we will use the following command:

```
adavtyan@artur-lpt:~$ sudo systemctl stop [service_name]
```

Meanwhile, to check the status of a service we can use:

```
adavtyan@artur-lpt:~$ sudo systemctl status [service_name]
```

It is also possible to have a service run while the operating system is being loaded:

```
adavtyan@artur-lpt:~$ sudo systemctl enable [service_name]
```

Or remove it from the initial load:

```
adavtyan@artur-lpt:~$ sudo systemctl disable [service_name]
```

sourcemind

Install Linux NGINX Services

Install Nginx in the ubuntu

```
adavtyan@artur-lpt:~$ sudo apt install nginx
```

To check the status of a service we can use:

```
adavtyan@artur-lpt:~$ sudo systemctl status nginx
```

Set that service run while the operating system is being loaded:

```
adavtyan@artur-lpt:~$ sudo systemctl status nginx
```

Where story index.html file in the Nginx

```
adavtyan@artur-lpt:~$ ls -la /var/www/html
```

Where we can find nginx configs in the server

```
adavtyan@artur-lpt:~$ ls -la /etc/nginx
```

sourcemind

Thank you for your attention !

Q&A