Finding and Managing Files

Session 2

Table of contents

01 Finding files

02 Links

03 Compression and Archiving

04 Pipelining and Redirection

01

Finding Files

Finding Files

One of the ways that we can look for files in Linux is by using **find.**

This command allows us to search for files on our system based on different attributes, such as name, size, permissions, type, etc.

Find Command

The general syntax for the find command is as follows:

```
find [path...] [expression]
```

- The **path**... attribute defines the starting directory or directories where find will search the files.
- The **expression** attribute is made up of options, search patterns, and actions separated by operators.

Find Command - Options

Option	Description
`-name pattern`	Searches for files with a specific name or pattern.
`-iname pattern`	Case-insensitive version of -name. Searches for files with a specific name or pattern, regardless of case.
`-type type`	Specifies the type of file to search for (e.g., f for regular files, d for directories).
`-maxdepth`	limits how deep `find` will go into the directory tree. -> must be the first option

Find Command - Size

- Searches for files based on size: +n finds larger files, -n finds smaller files. n measures size in characters.

You can use the following suffixes to specify the file size:

- **b** : 512-byte blocks (default)
- **c** : bytes
- **k** : Kilobytes
- **M** : Megabytes
- **G** : Gigabytes

Example

- Case-Sensitive Search for a Specific File Name

```
fady@Ubuntu-labtop:~/Session2/MyFiles$ find . -name "main.txt"
./main.txt
```

- Case-Insensitive Search for a Specific File Name

```
fady@Ubuntu-labtop:~/Session2/MyFiles$ find . -iname "second.txt"
./SEcond.txt
./SECOND.TXT
./second.txt
```

Example

Find Text Files in the Current Directory Only

- Explanation: Finds all files with .txt extension (case-sensitive) only in the current directory (no subdirectories searched).

```
fady@Ubuntu-labtop:~/Session2/MyFiles$ find . -maxdepth 1 -name "*.txt"
./SEcond.txt
./main.txt
./second.txt
```

Example

- Find All Directories in the Current Path

```
fady@Ubuntu-labtop:~/Session2/MyFiles$ find . -type d
.
./Dir1
```

- Find Files Larger Than 18 Bytes

```
fady@Ubuntu-labtop:~/Session2/MyFiles$ find . -size +18c
.
./SEcond.txt
./Dir1
```

Find - Cheat Sheet

Option	Description	Notes
`-name`	Search by exact name (case-sensitive) or pattern	Matches exactly `file.txt` or any pattern `"*.txt"`
`-iname`	Search by name (case-insensitive)	Matches `file.txt`, `File.TXT` etc.
`-type`	Search by file type	`f` = file, `d` = directory,
`-size`	Search by file size	`+` greater, `-` smaller, no sign = exact size
		Units: `b` (512-bytes-block), `c` (bytes), `k` (KB), `M` (MB), `G` (GB)
`-maxdepth`	Limit search depth in directory hierarchy	1 = current dir only, 2 = include subdirs, etc.

Hands on #1

Find_Practice

- Create hands-on directory in your home and go to it
- Create three directories and name it OSC myDir1 myDir2
- Create file with name OSC.TXT
- Create another file with name osc.TXT
- Now, use file command to search on:

1. Any **file** start with name osc -> ignore Capital and small letters
2. Any **directory** start with name my

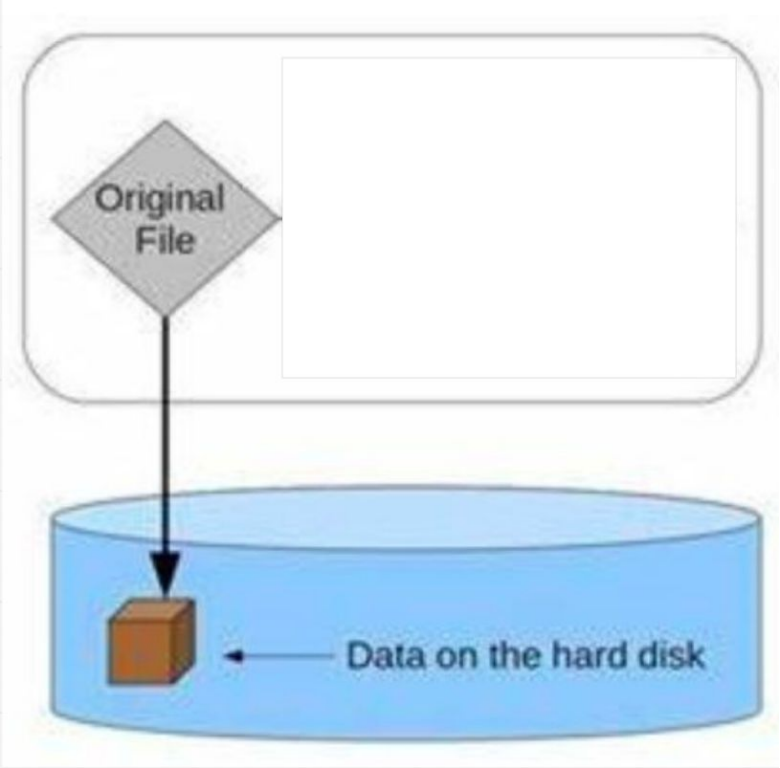
Find_Practice Solution

- mkdir ~/hands-on
- cd ~/hands-on
- mkdir OSC myDir1 myDir2
- touch OSC.TXT
- touch osc.TXT
- find . -type f -iname "osc*"
- find . -type d -name "my*"

02

Links

Any file in linux -> Point on his data -> Contain his address on disk



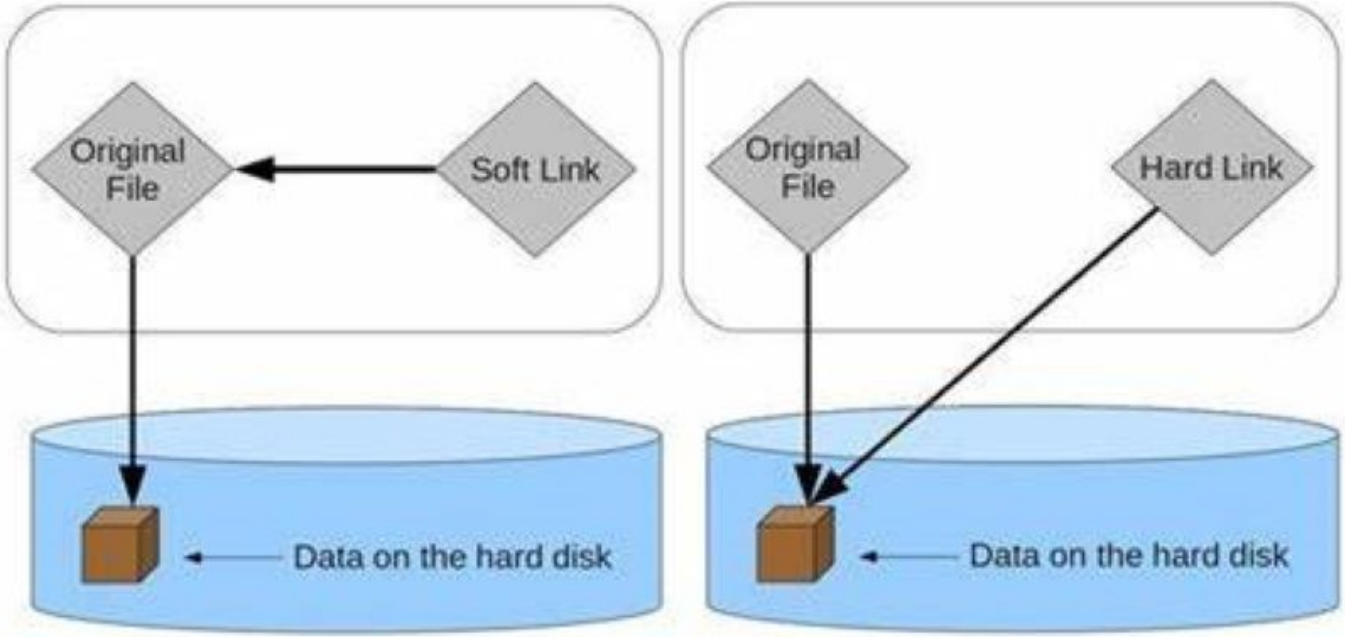
What are Links?

- A **link** in Linux is a file that points to another file/directory.
- Creating links is similar to creating shortcuts.
- A file can have **multiple links** linked to it. But a link can only be linked to (pointed to) one file.

There are two types of links:

1. Soft (Symbolic) link.
2. Hard link.

Soft Link VS Hard Link



Soft Link (Symbolic)

- They can point to a directory or special file, not just a regular file.
- If the original file is deleted it stop working
- Created by: **ln -s [file path] [link path]**
- Remove using: **rm [link path]** or **unlink [link path]**

Hard Link

- Can only be used on files
- If the original file is deleted it still works
- Created by: **ln filename linkname**
- Remove using: **rm link** or **unlink link**
- You can verify if a file has hard links with the **ls -li** command.

Example

- Create Soft Link

```
bebo@bebo-G3-3590:~/Links$ ls
file.txt
bebo@bebo-G3-3590:~/Links$ ln -s file.txt softlink.txt
bebo@bebo-G3-3590:~/Links$ ls -l
total 0
-rw-rw-r-- 1 bebo bebo 0 Aug  6 02:00 file.txt
lrwxrwxrwx 1 bebo bebo 8 Aug  6 02:05 softlink.txt -> file.txt
```

Example

- Create Hard Link

```
bebo@bebo-G3-3590:~/Links$ ls
file.txt  softlink.txt
bebo@bebo-G3-3590:~/Links$ ln file.txt hardlink.txt
bebo@bebo-G3-3590:~/Links$ ls -l
total 0
-rw-rw-r-- 2 bebo bebo 0 Aug  6 02:00 file.txt
-rw-rw-r-- 2 bebo bebo 0 Aug  6 02:00 hardlink.txt
lrwxrwxrwx 1 bebo bebo 8 Aug  6 02:05 softlink.txt -> file.txt
```

Deleting a Soft Link (Symbolic Link):

- Effect: Only the symbolic link itself is deleted.
- Original File: The original file remains unaffected and intact.
- Other Links: Any other links (hard or soft) to the original file remain unaffected.

Deleting a Hard Link:

- Effect: The specific hard link is removed.
- Original File: The original file is not deleted as long as there is at least one remaining hard link to it.
- Other Links: Any other hard links to the file continue to function normally.
- The file's content remains accessible through these links

Hands on #1-2

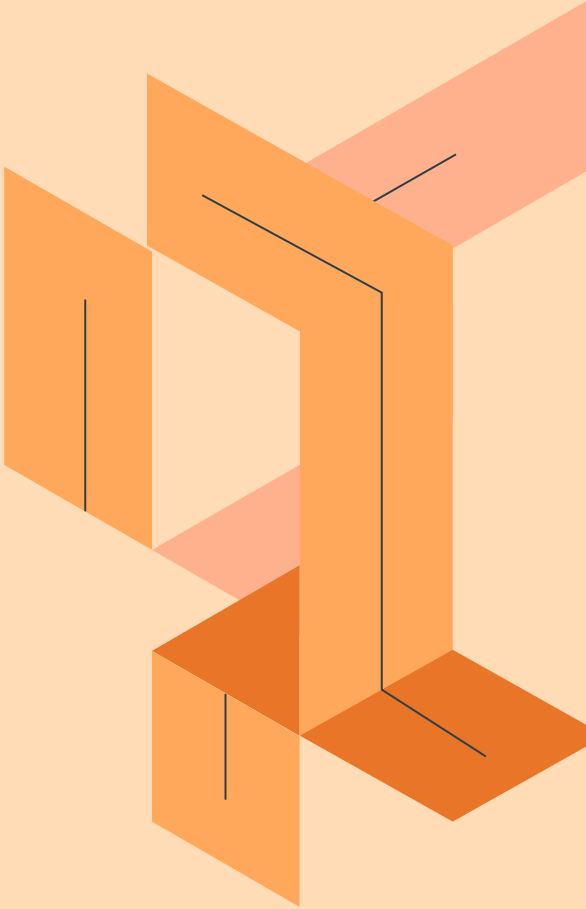
Links Practice

- Use nano to create file1.txt & file2.txt with any content
- Create a hard link to file1.txt named hardlink.
- Create a soft link (symbolic) to file2.txt named softlink.
- Verify links
- Delete the original file2.txt and try to open softlink.

Links Practice Solution

- Create a hard link to file1.txt named hardlink.
    - ln file1.txt hardlink
- Create a soft (symbolic) link to file2.txt named softlink.
    - ln -s file2.txt softlink
- Verify links
    - ls -li
- Delete the original file2.txt and try to open softlink
    - rm file2.txt
    - cat softlink_to_file2 # will show "No such file or directory"

Break.. ☺



03

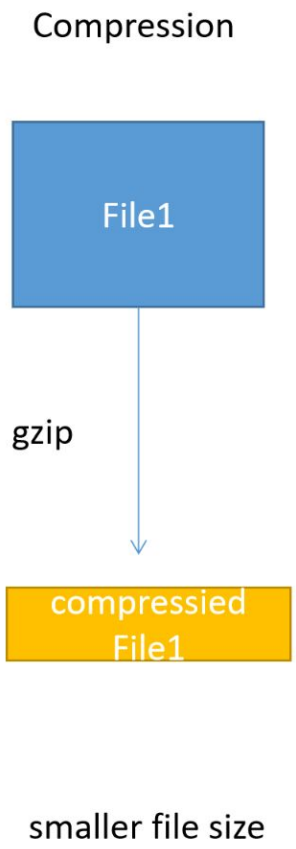
Compression & Archiving

Compression

Compression, in computer science language, is a process that aims to represent the data contained in a file with less data.

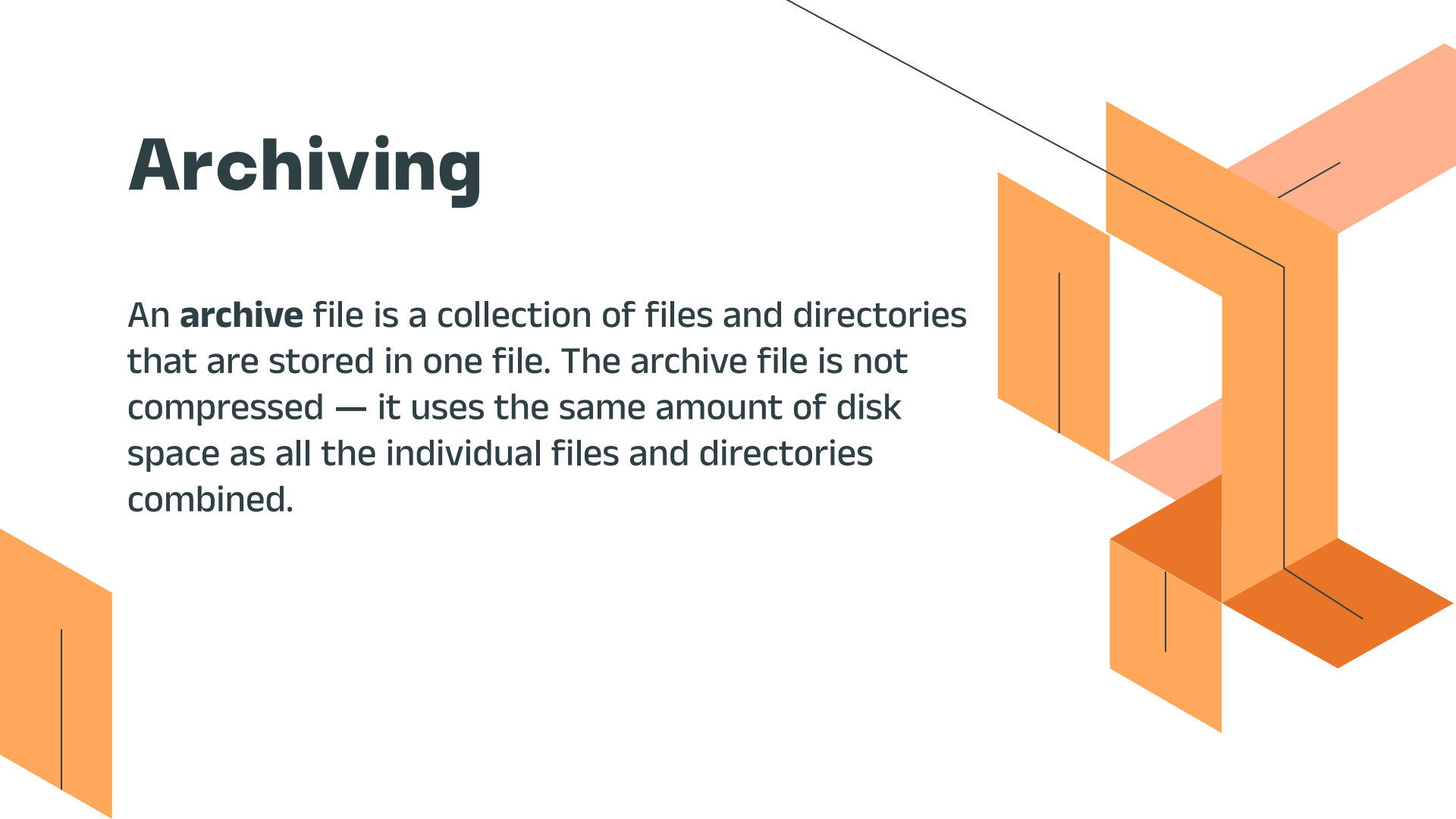
Compression

Compression, in computer science language, is a process that aims to represent the data contained in a file with less data.



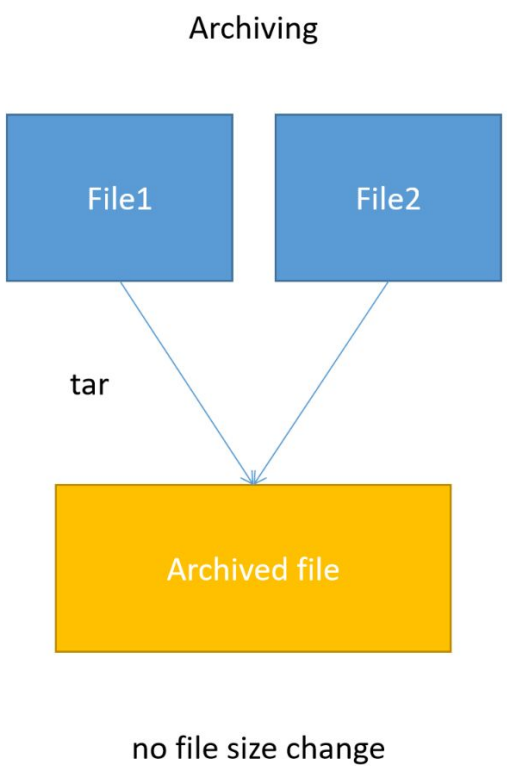
Archiving

An **archive** file is a collection of files and directories that are stored in one file. The archive file is not compressed — it uses the same amount of disk space as all the individual files and directories combined.

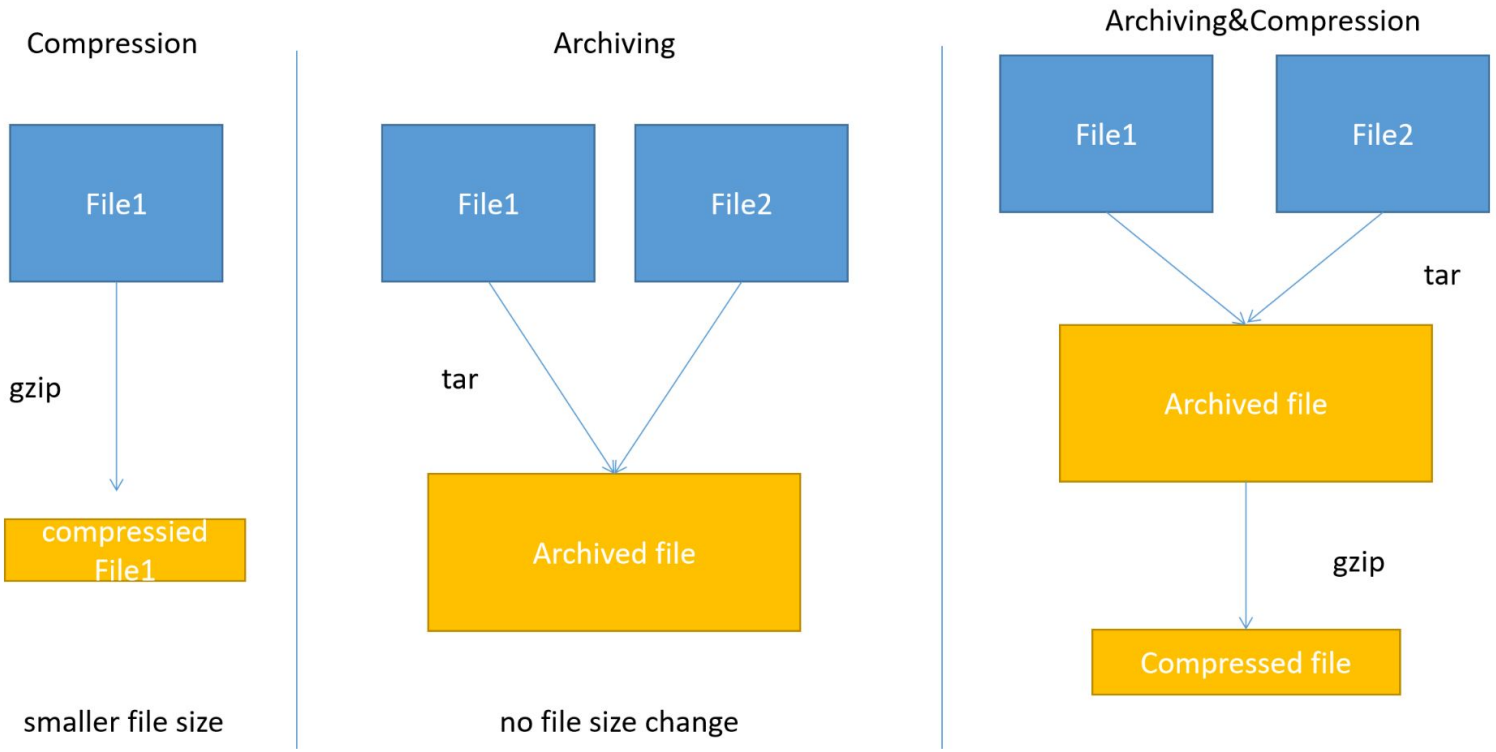


Archiving

An **archive** file is a collection of files and directories that are stored in one file. The archive file is not compressed — it uses the same amount of disk space as all the individual files and directories combined.



Compression VS Archiving



Tools

zip

gzip

bzip2

tar

Tool	Compression Algorithm	Utility	Year
`zip`	Deflate	Compressor and Archiver	1989
`gzip`	Deflate	Compressor	1992
`bzip2`	BWT + Huffman coding	Compressor	1998

zip

This tool does both compression and archiving.

Tool	Extension	Decompression Tool	Example
zip	.zip	unzip	**Compress :** zip file.zip fileName **Decompress** unzip fileName.zip

- **To compress multiple files :**
  `zip files.zip file1 file2 file3` → **Output :** files.zip

- **To compress multiple files and directories :**
  `zip -r filename.zip file1 file2 file3 /usr/work/school`
  - The above command compresses file1, file2, file3, and the contents of /usr/work/school and places them in an archive named **filename.zip**.

zip

This tool does both compression and archiving.

Tool	Extension	Decompression Tool
zip	.zip	unzip

Syntax:

```
zip [options] zipname.zip files
```

Example:

- **Compress:** `zip file.zip fileName`

```
📍Compression
›ls -lh
total 1.0M
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:50 file

📍Compression
›zip file.zip file
  adding: file (deflated 100%)

📍Compression
›ls -lh
total 1.1M
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:50 file
-rw-rw-r-- 1 hadeer hadeer 1.2K Aug  5 22:52 file.zip
```

Example:

- **Decompress** `unzip fileName.zip`

```
📍Compression
>ls
file.zip

📍Compression
>unzip file.zip
Archive:  file.zip
  inflating: file

📍Compression
>ls
file  file.zip
```

Example:

- **To compress multiple files :**
  `zip files.zip file1 file2 file3` → **Output:** files.zip

```
📍Compression
›zip files.zip file1 file2 file3
  adding: file1 (deflated 100%)
  adding: file2 (deflated 100%)
  adding: file3 (deflated 100%)

📍Compression
›ls -lh
total 3.1M
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:56 file1
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:56 file2
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:56 file3
-rw-rw-r-- 1 hadeer hadeer 3.5K Aug  5 22:57 files.zip
```

Example:

- **To compress Directory:**
  `zip -r Dir.zip Dir/`

```
›ls
Dir

📍Compression
›zip -r Dir.zip Dir/
  adding: Dir/ (stored 0%)
  adding: Dir/file3 (deflated 100%)
  adding: Dir/file1 (deflated 100%)
  adding: Dir/file2 (deflated 100%)

📍Compression
›ls
Dir  Dir.zip
```

Example:

- **To compress multiple files and directories :**
  `zip -r Data.zip file1 file2 file3 Dir/`

```
›ls
Dir  file2  file3

📍Compression
›zip -r Data.zip file2 file3 Dir/
  adding: file2 (deflated 100%)
  adding: file3 (deflated 100%)
  adding: Dir/ (stored 0%)
  adding: Dir/file1 (deflated 100%)

📍Compression
›ls
Data.zip  Dir  file2  file3
```

gzip and bzip2

These are compression-only tools.

Compression Tool	Extension	Decompre -ssion Tool	Syntax
`gzip`	`.gz`	`gunzip`	**Compress:** `gzip fileName` **Decompress:** `gunzip fileName.gz`
`bzip2`	`.bz2`	`bunzip2`	**Compress:** `bzip2 fileName` **Decompress:** `bunzip2 fileName.bz2`

Option	Description
`-1 .. -9`	Set amount of compression. Default is 6. ○ `-1`, `--fast`: **Compress** faster. ○ `-9`, `--best`: **Compress** better.
`-f`	**Force** compression even if a compressed version of the original file already exists.
`-k`	**Keep** a copy of the original file.
`-v`	**Verbose**.

gzip Example:

- **Compress & Decompress using gzip**

```
›ls -lh
total 1.0M
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:56 file2

📍Compression
›gzip file2

📍Compression
›ls -lh
total 4.0K
-rw-rw-r-- 1 hadeer hadeer 1.1K Aug  5 22:56 file2.gz

📍Compression
›gunzip file2.gz

📍Compression
›ls -lh
total 1.0M
-rw-rw-r-- 1 hadeer hadeer 1.0M Aug  5 22:56 file2
```

gzip Example:

- **Compress -1 vs -9**

```
📍Compression
›gzip -1 file1

📍Compression
›gzip -9 file2

📍Compression
›ls -lh
total 12K
-rw-rw-r-- 1 hadeer hadeer 4.6K Aug  5 23:39 file1.gz
-rw-rw-r-- 1 hadeer hadeer 1.1K Aug  5 22:56 file2.gz
```

gzip Example:

- **Keep files and force compression**

```
›gzip -k file1

📍Compression
›ls
file1  file1.gz

📍Compression
›echo "hi" >> file1

📍Compression
›gzip -k file1
gzip: file1.gz already exists; do you wish to overwrite (y or n)? y

📍Compression
›gzip -kf file1
```

bzip2 Example:

- **Compress & Decompress**

```
›ls -lh
total 1.1M
-rw-rw-r-- 1 hadeer hadeer 1.1M Aug  6 00:40 file

📍Compression
›bzip2 file

📍Compression
›ls -lh
total 4.0K
-rw-rw-r-- 1 hadeer hadeer 54 Aug  6 00:40 file.bz2

📍Compression
›bunzip2 file.bz2

📍Compression
›ls
file
```

bzip2 Example:

- **Compress -1 vs -9**

```
›ls -lh
total 10M
-rw-rw-r-- 1 hadeer hadeer 5.0M Aug  6 00:49 file1
-rw-rw-r-- 1 hadeer hadeer 5.0M Aug  6 00:49 file2

📍Compression
›bzip2 -1 file1

📍Compression
›bzip2 -9 file2

📍Compression
›ls
file1.bz2  file2.bz2

📍Compression
›ls -lh
total 8.0K
-rw-rw-r-- 1 hadeer hadeer 78 Aug  6 00:49 file1.bz2
-rw-rw-r-- 1 hadeer hadeer 48 Aug  6 00:49 file2.bz2
```

bzip2 Example:

- **Keep files and force compression**

```
›bzip2 -k file

📍Compression
›ls
file  file.bz2

📍Compression
›bzip2 -k file
bzip2: Output file file.bz2 already exists.

📍Compression
›bzip2 -kf file

📍Compression
›bzip2 -kfv file
  file:    109226.667:1,  0.000 bits/byte, 100.00% saved, 5242880 in, 48 out.

📍Compression
›ls
file  file.bz2
```

tar (**t**ape **ar**chive)

tar is an archiving tool.

```
tar -options -f <archive name> <files to be archived>
```

```
tar -options -f <archive name> <files to be archived>
```

What do you want to do?

- -c (create)
- -x (extract)
- -r (append)
- -t (list content)

Compress?

- -z (gzip)
- -j (bzip2)

Optional

- -v (verbose) (مطوَّل)

Note: -f must be followed by the archive file name.

Making a tarball (a tar archive)

```
myusername@ubuntu:~/osc/summer25/redpip$ tar -cvf mytar filestxt filespdf
filestxt
filespdf
myusername@ubuntu:~/osc/summer25/redpip$ tar -tvf mytar
-rw-rw-r-- myusername/myusername 24 2025-08-04 21:15 filestxt
-rw-rw-r-- myusername/myusername 48 2025-08-04 21:14 filespdf
```

Appending to it

```
myusername@ubuntu:~/osc/summer25/redpip$ tar -rvf mytar filespng
filespng
myusername@ubuntu:~/osc/summer25/redpip$ tar -tvf mytar
-rw-rw-r-- myusername/myusername 24 2025-08-04 21:15 filestxt
-rw-rw-r-- myusername/myusername 48 2025-08-04 21:14 filespdf
-rw-rw-r-- myusername/myusername 36 2025-08-04 21:15 filespng
```

Making a gzipped tar archive

```
myusername@ubuntu:~/osc/summer25/redpip$ tar -cvzf gzippedtar filestxt filespdf
filestxt
filespdf
myusername@ubuntu:~/osc/summer25/redpip$ file gzippedtar
gzippedtar: gzip compressed data, from Unix, original size modulo 2^32 10240
```

Making a bzipped tar archive

```
myusername@ubuntu:~/osc/summer25/redpip$ tar -cvjf bzippedtar filestxt filespdf
filestxt
filespdf
myusername@ubuntu:~/osc/summer25/redpip$ file bzippedtar
bzippedtar: bzip2 compressed data, block size = 900k
```

Hands on #3

1. Create a file named file1.
2. Compress file1 using zip.
3. Compress file1 using gzip.
4. Compress file1 using bzip2.
5. Using nano text editor, edit file1.
6. Compress file1 using bzip2.
7. Using tar, archive the 3 compressed versions of file1.
8. Finally, decompress all the compressed files.

Solution

- Create a file named file1.

```
touch file1
```

- Compress file1 using zip.

```
zip file1.zip file1
```

- Compress file1 using gzip.

```
gzip -k file1
```

- Compress file1 using bzip2.

```
bzip2 -k file1
```

- Using nano text editor, edit file1.

```
nano file1
```

- Compress file1 using bzip2.

```
bzip2 -kf file1
```

- Using tar, archive the 3 compressed versions of file1.

```
tar -cf mytar.tar file1.zip file1.gz file.bz2
```

- Finally, decompress all the compressed files.

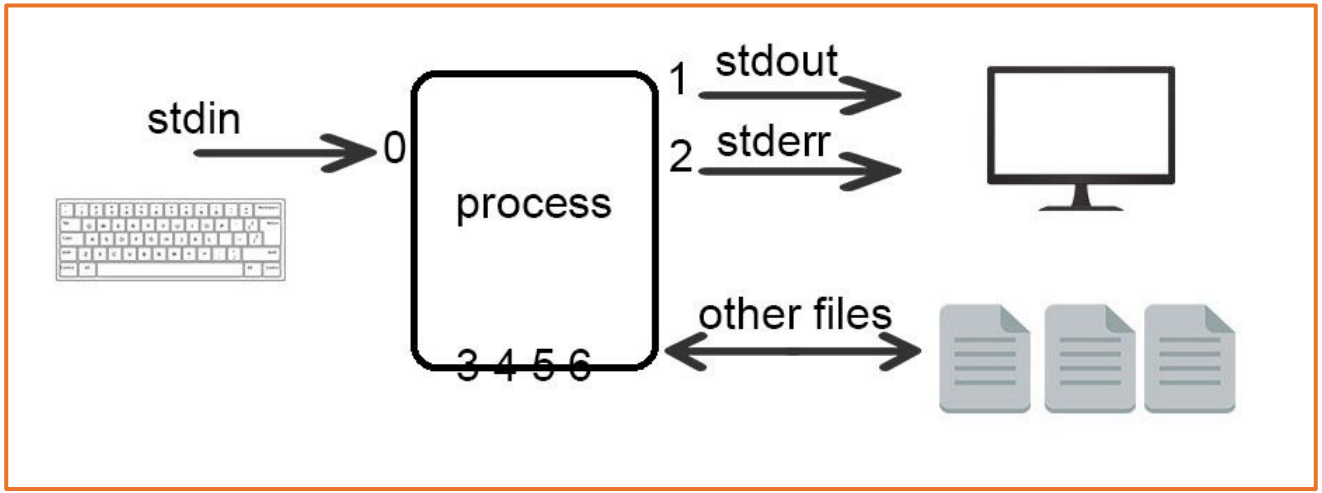
```
unzip file1.zip
gunzip file1.gz
bunzip2 file1.bz2
```

04

Pipelining & Redirection

Standard Channels

Processes use numbered **channels** to manage open files. Processes are created with default connections for channels 0, 1, and 2, known as standard input, standard output, and standard error. They use channels 3 and above to connect to other files.



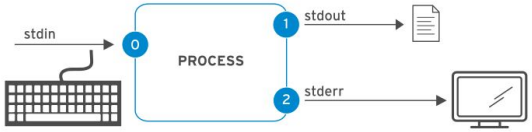
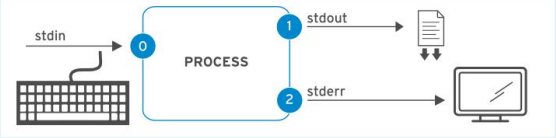
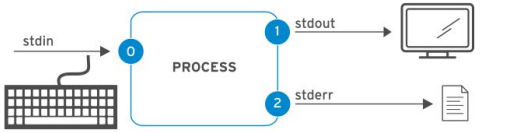
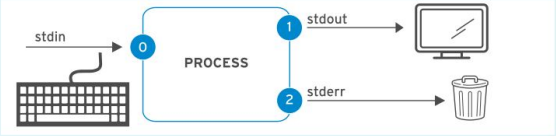
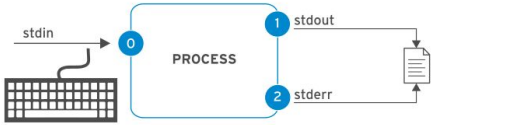
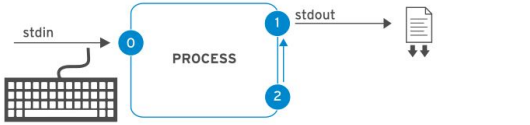
Standard Channels

No.	Channel Name	Description	Default Connection	Usage
0	stdin	Standard input	Keyboard	read only
1	stdout	Standard output	Terminal	write only
2	stderr	Standard error	Terminal	write only
3+	filename	Other files	none	read/write

Redirection

We can redirect output channels (stdout and stderr) to files instead of the terminal.

- **>** : Overwrite
- **>>** : Append

USAGE	EXPLANATION	VISUAL AID
> file	redirect **stdout** to overwrite a file	
>> file	redirect **stdout** to append to a file	
2> file	redirect **stderr** to overwrite a file	
2> /dev/null	discard **stderr** error messages by redirecting to **/dev/null**	
> file 2>&1 *&> file*	redirect **stdout** and **stderr** to overwrite the same file	
>> file 2>&1 *&>> file*	redirect **stdout** and **stderr** to append to the same file	

Redirection

Redirection, in simple words, is just the process of editing a file descriptor table entry.
We can redirect output channels (stdout and stderr) to files instead of the terminal.

i.e.:

- Redirecting stderr: command 2> file.txt
- Redirecting stdout: command > file.txt

Note:

- **>** : Overwrite
- **>>** : Append

Writing to a file using redirection

```
myusername@ubuntu:~/osc/summer25$ cat hi.txt
hi
myusername@ubuntu:~/osc/summer25$ echo bye > hi.txt
myusername@ubuntu:~/osc/summer25$ cat hi.txt
bye
```

appending to the file

```
myusername@ubuntu:~/osc/summer25$ cat hi.txt
bye
myusername@ubuntu:~/osc/summer25$ echo hi >> hi.txt
myusername@ubuntu:~/osc/summer25$ cat hi.txt
bye
hi
```

stderr redirection

```
myusername@ubuntu:~/osc/summer25$ ls
comp  hi.txt  redpip  showfds
myusername@ubuntu:~/osc/summer25$ ls hi
ls: cannot access 'hi': No such file or directory
myusername@ubuntu:~/osc/summer25$ ls hi 2> errors.txt
myusername@ubuntu:~/osc/summer25$ ls
comp  errors.txt  hi.txt  redpip  showfds
myusername@ubuntu:~/osc/summer25$ cat errors.txt
ls: cannot access 'hi': No such file or directory
```

“What we want to do is a mechanism connecting programs together just like screwing pieces of garden hose together.”

- Doug McIlroy

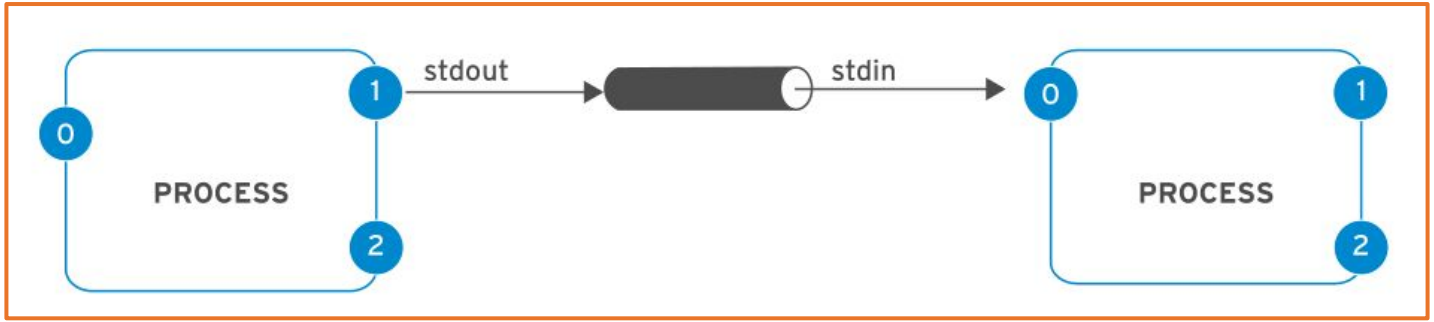
“We should have some ways of connecting programs like garden hose..”

- Doug McIlroy

Pipelining

A **pipeline** is a sequence of one or more commands separated by the pipe character (|).

A pipe connects the standard output of the first command to the standard input of the next command.



`wc -l` (a program that counts the number of lines)

```
myusername@ubuntu:~/osc/summer25/comp$ ls -l
total 0
-rw-rw-r-- 1 myusername myusername 0 Aug  5 22:07 file1
-rw-rw-r-- 1 myusername myusername 0 Aug  5 22:07 file2
-rw-rw-r-- 1 myusername myusername 0 Aug  5 22:07 file3
-rw-rw-r-- 1 myusername myusername 0 Aug  5 22:07 file4
-rw-rw-r-- 1 myusername myusername 0 Aug  5 22:07 file5
myusername@ubuntu:~/osc/summer25/comp$ ls -l | wc -l
6
```

`sort` (a program that sorts :))

```
myusername@ubuntu:~/osc/summer25/comp$ cat newfile
z
c
a
h
b
myusername@ubuntu:~/osc/summer25/comp$ cat newfile | sort
a
b
c
h
z
```

Redirection vs Pipelining (Practical-wise)

Redirection: command > file

Pipelining: command | command

Hands on #4

1. Create a file named **output.txt**
2. Redirect the output of this command **“echo hello“** to **output.txt**
3. Redirect the output of this command **“ls -l”** to **output.txt**
4. Count **output.txt** lines and redirect it to **count.txt**

Solution

- Create a file named **output.txt**
  touch output.txt

- Redirect the output of this command **“echo hello“** to **output.txt**
  echo hello > output.txt

- Append the output of this command **“ls -l”** to **output.txt**
  ls -l >> output.txt

- Count **output.txt** lines and redirect it to **count.txt**
  cat output.txt | wc -l > count.txt

Thanks!