```
elsayed@SIC:~$ touch /home/elsayed/iot_logger/logs/temp.log
elsayed@SIC:~$ touch /home/elsayed/iot_logger/scripts/sensor_scripts.py
elsayed@SIC:~$ cp /etc/services /home/elsayed/iot_logger/data/
elsayed@SIC:~$ grep -i "ssh" /home/elsayed/iot_logger/data/services
ssh             22/tcp                      # SSH Remote Login Protocol
elsayed@SIC:~$ grep -i "http" /home/elsayed/iot_logger/data/services
# Updated from https://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xhtml .
http            80/tcp          www         # WorldWideWeb HTTP
https           443/tcp                     # http protocol over TLS/SSL
https           443/udp                     # HTTP/3
http-alt        8080/tcp        webcache    # WWW caching service
hkp             11371/tcp                   # OpenPGP HTTP Keyserver
elsayed@SIC:~$ grep "^t" /home/elsayed/iot_logger/data/services
tcpmux          1/tcp                       # TCP port service multiplexer
telnet          23/tcp
time            37/tcp          timserver
time            37/udp          timserver
tacacs          49/tcp                      # Login Host Protocol (TACACS)
tacacs          49/udp
tftp            69/udp
talk            517/udp
tinc            655/tcp                     # tinc control port
tinc            655/udp
telnets         992/tcp                     # Telnet over SSL
tproxy          8081/tcp                    # Transparent Proxy
tfido           60177/tcp                   # fidonet EMSI over telnet
elsayed@SIC:~$ grep "0-9" /home/elsayed/iot_logger/data/services
elsayed@SIC:~$ find /home/elsayed -name "*.text"
elsayed@SIC:~$ rm /home/elsayed/tempfile.txt
rm: cannot remove '/home/elsayed/tempfile.txt': No such file or directory
elsayed@SIC:~$ find /home/elsayed -name "temp.text"
elsayed@SIC:~$ rm /home/elsayed/temp.txt
rm: cannot remove '/home/elsayed/temp.txt': No such file or directory
elsayed@SIC:~$ find /home/elsayed -name "temp.text"
elsayed@SIC:~$ ln  /home/elsayed/iot_logger/logs/temp.log /home/elsayed/iot_logger/logs/temp_hardlink
elsayed@SIC:~$ ln -s  /home/elsayed/iot_logger/logs/temp.log /home/elsayed/iot_logger/logs/temp_symlink
elsayed@SIC:~$ tree /home/elsayed/iot_logger
Command 'tree' not found, but can be installed with:
sudo snap install tree  # version 2.1.3+pkg-5852, or
sudo apt  install tree  # version 2.0.2-1
See 'snap info tree' for additional versions.
elsayed@SIC:~$ sudo apt install tree
[sudo] password for elsayed:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-6.8.0-40-generic linux-hwe-6.8-headers-6.8.0-40 linux-hwe-6.8-tools-6.8.0-40 linux-image-6.8.0-40-generic linux-modules
  linux-tools-6.8.0-40-generic
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 47.9 kB of archives.
After this operation, 116 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/universe amd64 tree amd64 2.0.2-1 [47.9 kB]
```

```
rm: cannot remove '/home/elsayed/temp.txt': No such file or directory
elsayed@SIC:~$ find /home/elsayed -name "temp.text"
elsayed@SIC:~$ ln  /home/elsayed/iot_logger/logs/temp.log /home/elsayed/iot_logger/logs/temp_hardlink
elsayed@SIC:~$ ln -s  /home/elsayed/iot_logger/logs/temp.log /home/elsayed/iot_logger/logs/temp_symlink
elsayed@SIC:~$ tree /home/elsayed/iot_logger
Command 'tree' not found, but can be installed with:
sudo snap install tree  # version 2.1.3+pkg-5852, or
sudo apt  install tree  # version 2.0.2-1
See 'snap info tree' for additional versions.
elsayed@SIC:~$ sudo apt install tree
[sudo] password for elsayed:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-6.8.0-40-generic linux-hwe-6.8-headers-6.8.0-40 linux-hwe-6.8-tools-6.8.0-40 linux-image-6.8.0-40-generic linux-modules-6.8.0-40-generic linux-modules-e
  linux-tools-6.8.0-40-generic
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 47.9 kB of archives.
After this operation, 116 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/universe amd64 tree amd64 2.0.2-1 [47.9 kB]
Fetched 47.9 kB in 1s (43.1 kB/s)
Selecting previously unselected package tree.
(Reading database ... 240078 files and directories currently installed.)
Preparing to unpack .../tree_2.0.2-1_amd64.deb ...
Unpacking tree (2.0.2-1) ...
Setting up tree (2.0.2-1) ...
Processing triggers for man-db (2.10.2-1) ...
^[[A^[[Belsayed@SIC:~$ tree /home/elsayed/iot_logger
/home/elsayed/iot_logger
|-- data
|   `-- services
|-- logs
|   |-- temp_hardlink
|   |-- temp.log
|   `-- temp_symlink -> /home/elsayed/iot_logger/logs/temp.log
`-- scripts
    `-- sensor_scripts.py

3 directories, 5 files
elsayed@SIC:~$ ls -R /home/elsayed/iot_logger
/home/elsayed/iot_logger:
data  logs  scripts

/home/elsayed/iot_logger/data:
services

/home/elsayed/iot_logger/logs:
temp_hardlink  temp.log  temp_symlink

/home/elsayed/iot_logger/scripts:
sensor_scripts.py
elsayed@SIC:~$ SSS
```

# 1. Types of files in Linux

- **Regular file** → Normal data (text, binary, code). Example: `temperature.log`.
- **Directory** → A folder containing files and subfolders. Example: `/etc`.
- **Symbolic link (symlink)** → A shortcut pointing to another file. Example: `temp_symlink`.
- **Hard link** → A duplicate reference to the same data block on disk.
- **Device files**:
  - **Character device** → Data is read/write character by character (e.g., `/dev/tty`).
  - **Block device** → Data handled in blocks (e.g., `/dev/sda`).
- **Socket** → Special file for inter-process communication (e.g., `/var/run/docker.sock`).
- **Pipe (FIFO)** → Used for process-to-process streaming.

## 2. Hard link vs. Symbolic link

- **Hard link**:
    - o Points directly to the same inode (same physical data).
    - o File still exists even if the original is deleted.
    - o Limitation: can't link across different filesystems.
    - o Example use: Backups, ensuring critical logs aren't lost.
- **Symbolic link**:
    - o Acts like a shortcut, storing a path to the target file.
    - o If the original is deleted, the symlink becomes broken.
    - o Example use: Shortcuts in `/usr/bin` pointing to real executables.

## 3. `rmdir` vs. `rm -r`

- `rmdir` → Only removes **empty directories**.
- `rm -r` → Recursively removes a directory and all its contents (files + subdirs).

    ⚠️ `rm -r` is dangerous if used carelessly (e.g., `rm -rf /`).