# ULI101: INTRODUCTION TO UNIX / LINUX AND THE INTERNET

## WEEK 8: LESSON 1

## LINKING FILES

# LESSON 1 TOPICS

**Linking Files**

- i-nodes
- Hard Links / Demonstration
- Symbolic Links / Demonstration

**Perform Week 8 Tutorial**

- Investigation 1
- Review Questions (Questions 1 – 2)

# LINKING FILES

## inode (index) Number of a File:

The **i-node number** is like a "**finger-print"** which is **unique** for each file on the Unix / Linux file system.

The i-node is an **index** (**data structure**) that provides information about the file such as if the file is a **directory** or **regular file**, etc.

Referring to the diagram below, issuing the **ls** command using the **-i** option displays the **i-node** number for each file. You can see that each file has its own **unique** *i-node* number in the file system.

```
[ murray.saul ] ls -li
total 0
1162999961 -rw-r--r-- 1 murray.saul users 0 Jan 31 07:26 a.txt
1164541350 -rw-r--r-- 1 murray.saul users 0 Jan 31 07:26 b.txt
1165743019 -rw-r--r-- 1 murray.saul users 0 Jan 31 07:26 c.txt
2248130583 drwxr-xr-x 2 murray.saul users 6 Jan 31 07:26 mydir
```

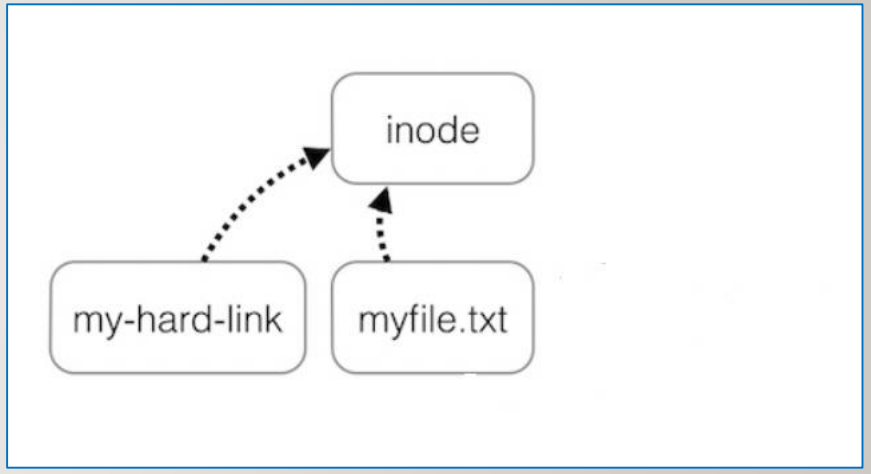
# LINKING FILES

## Hard Links

A **Hard link** is a **reference** to the **same index** on a file system. It does this by creating a file that **shares the same i-node number** with the other file.

An **advantage** of using hard links is that if one hard link remains (even if original file has been removed), **the data in that hard-linked file is NOT lost**. Also, any change to each file will be reflected in any hard-linked file which is useful for **backups**.

**Limitations** of hard links are that **they take-up extra space**, you **cannot hard link directories**. Also, you **cannot hard link files from other Unix/Linux servers** (since the i-node number may already be used by the other Unix/Linux server).



# LINKING FILES

## Hard Links

*Examples:*

```
touch myfile.txt
ln myfile.txt myfile1.hard.lnk
ln myfile.txt myfile2.hard.lnk
ln myfile.txt ~/backups/myfile.hard.lnk
ls -li myfile*
```

```
[ murray.saul ] pwd
/home/murray.saul/link-demo1
[ murray.saul ] touch myfile.txt
[ murray.saul ] ln myfile.txt myfile1.hard.lnk
[ murray.saul ] ln myfile.txt myfile2.hard.lnk
[ murray.saul ] ln myfile.txt ~/myfile3.hard.lnk
[ murray.saul ]
[ murray.saul ] ls -li . ~/myfile3.hard.lnk
3261599590 -rw-r--r-- 4 murray.saul users  0 Feb  3 08:39 /home/murray.saul/myfile3.hard.lnk

.:
total 0
3261599590 -rw-r--r-- 4 murray.saul users 0 Feb  3 08:39 myfile.txt
3261599590 -rw-r--r-- 4 murray.saul users 0 Feb  3 08:39 myfile1.hard.lnk
3261599590 -rw-r--r-- 4 murray.saul users 0 Feb  3 08:39 myfile2.hard.lnk
```

# LINKING FILES

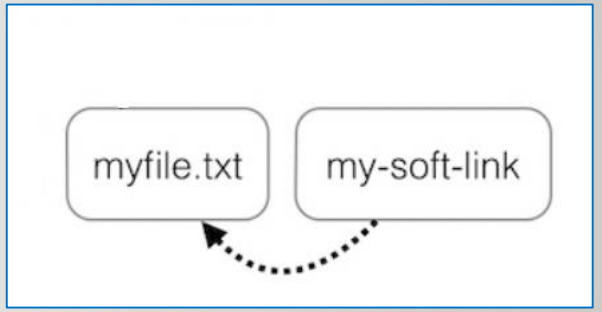
## Instructor Demonstration

Your instructor will now demonstrate how to create **Hard Links**.

# LINKING FILES

## Symbolic Links

A **Symbolic Link** is an **indirect pointer** to a file and are also known as a **soft link** or **symlink**. The symbolic link file contains the **pathname** to the original file.




An **advantage** of using symbolic links is they act as **shortcuts** to other files (in fact, the symbolic linked file only contains the pathname to the original file). Also, you can create symbolic links on **different** Unix/Linux servers, and that you can create symbolic links for **directories**.

A **limitation** of using symbolic links is that they are **NOT good for backup purposes** since a symbolic link can point to a **nonexistent** file (referred to as a "**broken link**").

# LINKING FILES

## Symbolic Links

*Examples:*

```
touch otherfile.txt
ln -s otherfile.txt otherfile1.sym.lnk
ln -s otherfile.txt otherfile2.sym.lnk
ln -s otherfile.txt ~/backups/otherfile.sym.lnk
ls -li otherfile*
```

```
[ murray.saul ] pwd
/home/murray.saul/link-demo2
[ murray.saul ] touch otherfile.txt
[ murray.saul ] ln -s otherfile.txt otherfile1.sym.lnk
[ murray.saul ] ln -s otherfile.txt otherfile2.sym.lnk
[ murray.saul ] ln -s ~murray.saul murray
[ murray.saul ] ls -li
total 0
3267712746 lrwxrwxrwx 1 murray.saul users 17 Feb  3 09:08 murray -> /home/murray.saul
3267712744 -rw-r--r-- 1 murray.saul users  0 Feb  3 09:08 otherfile.txt
3267712742 lrwxrwxrwx 1 murray.saul users 13 Feb  3 09:08 otherfile1.sym.lnk -> otherfile.txt
3267712745 lrwxrwxrwx 1 murray.saul users 13 Feb  3 09:08 otherfile2.sym.lnk -> otherfile.txt
```

# LINKING FILES

## Instructor Demonstration

Your instructor will now demonstrate how to create **Symbolic (Soft) links**.

# HOMEWORK

## Getting Practice

Perform **Week 8 Tutorial:**

**(Due: Friday Week 9 @ midnight for a 2% grade)**:

- INVESTIGATION 1: LINKING FILES
- LINUX PRACTICE QUESTIONS (Questions **1 – 2**)