```
$
$
$
$ cat TOPICS.txt

* Introduction
* Navigating files and folders
* Working with files and folders
* Pipes and filters - the programming model
* Loops
* Writing shell scripts

$ whoami
```

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- In Windows, you move mouse point and click.
- In Linux, you open a text terminal – *a shell* – and type something in it. You will do everything from the prompt – command line, it's called command driven.
- It allows you to do things under the hood, and quick.
- Typically you will need to perform the following routine tasks in shell:
  - » Finding files and folders
  - » Editing files
  - » Compiling programs
  - » Running programs
  - » Running many programs at once, many, many times
  - » Processing results (data files), e.g. extracting a portion of data, etc.
  - » Copying, moving, deleting files and folders, etc.

all by hand…?

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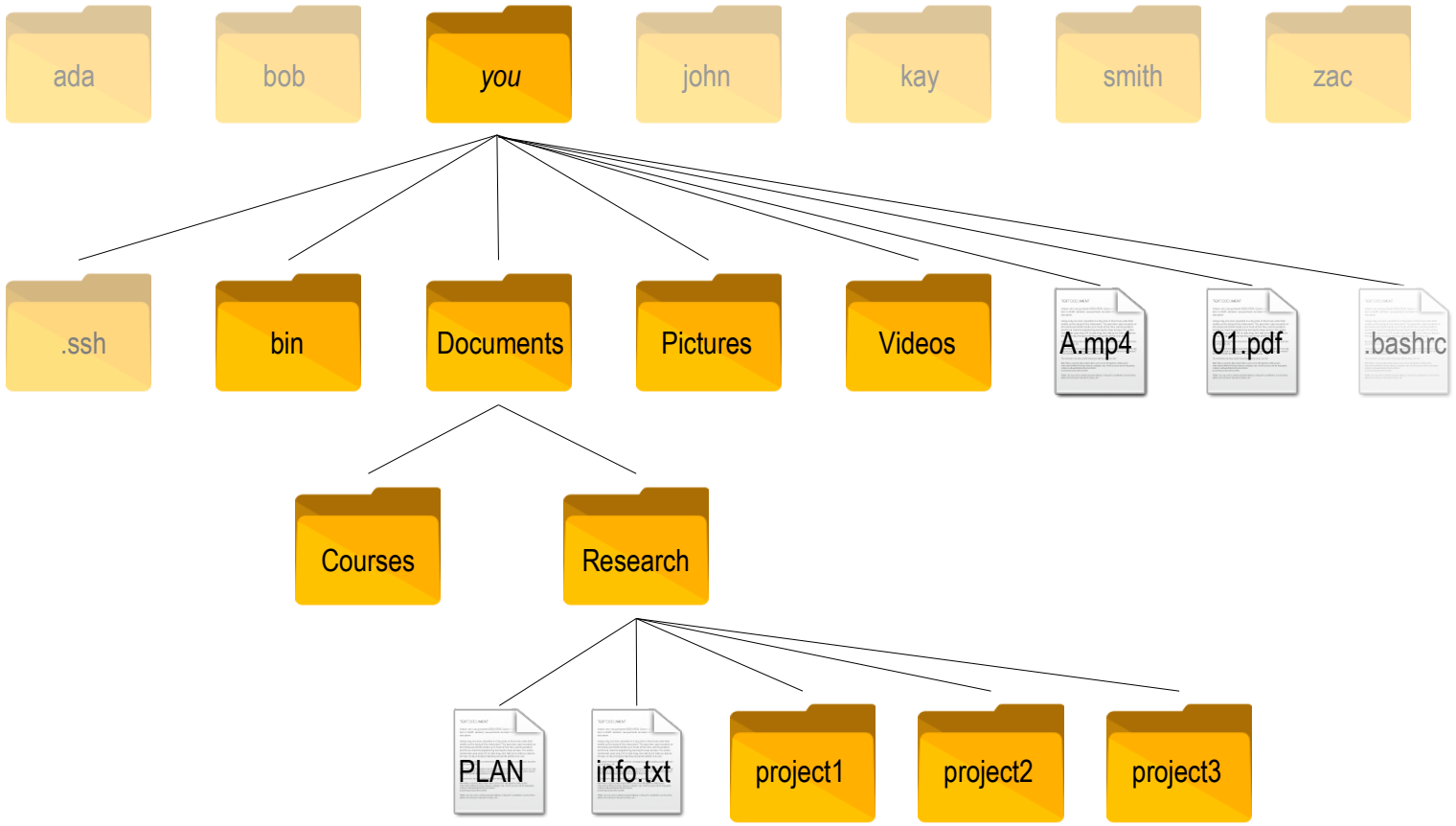
Navigating Files and Folders

Your files are stored on file systems. There are three file systems in SHARCNET you will care: /home/you, /work/you and /scratch/you.



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Note the special files

- One dot "." means current folder
- Two dots ".." mean the "parent" folder or upper level foder
- A file or folder prefixed with a dot is "hidden" and not display with the command **ls**.
- To see all files including "hidden" files in the current folder, use ls command with option -a, e.g.

  ls -a

Commonly used shell commands

- **ls** – to list files and directories.
- **pwd** – to find the path of the current working directory.
- **cd** – change directory to.
- **whoami** – to find what my user name is.
- **file** – to find the type of a file.
- **find** – to serachto find a file by name.
- **locate** – to find a file by name.
- **stat** – to find the existence of a file/folder.
- **grep** – to search files by content matching certain pattern.
- **man** – to see the manual for a command, look for See Also section to see more related commands – a way of getting to know more commands.

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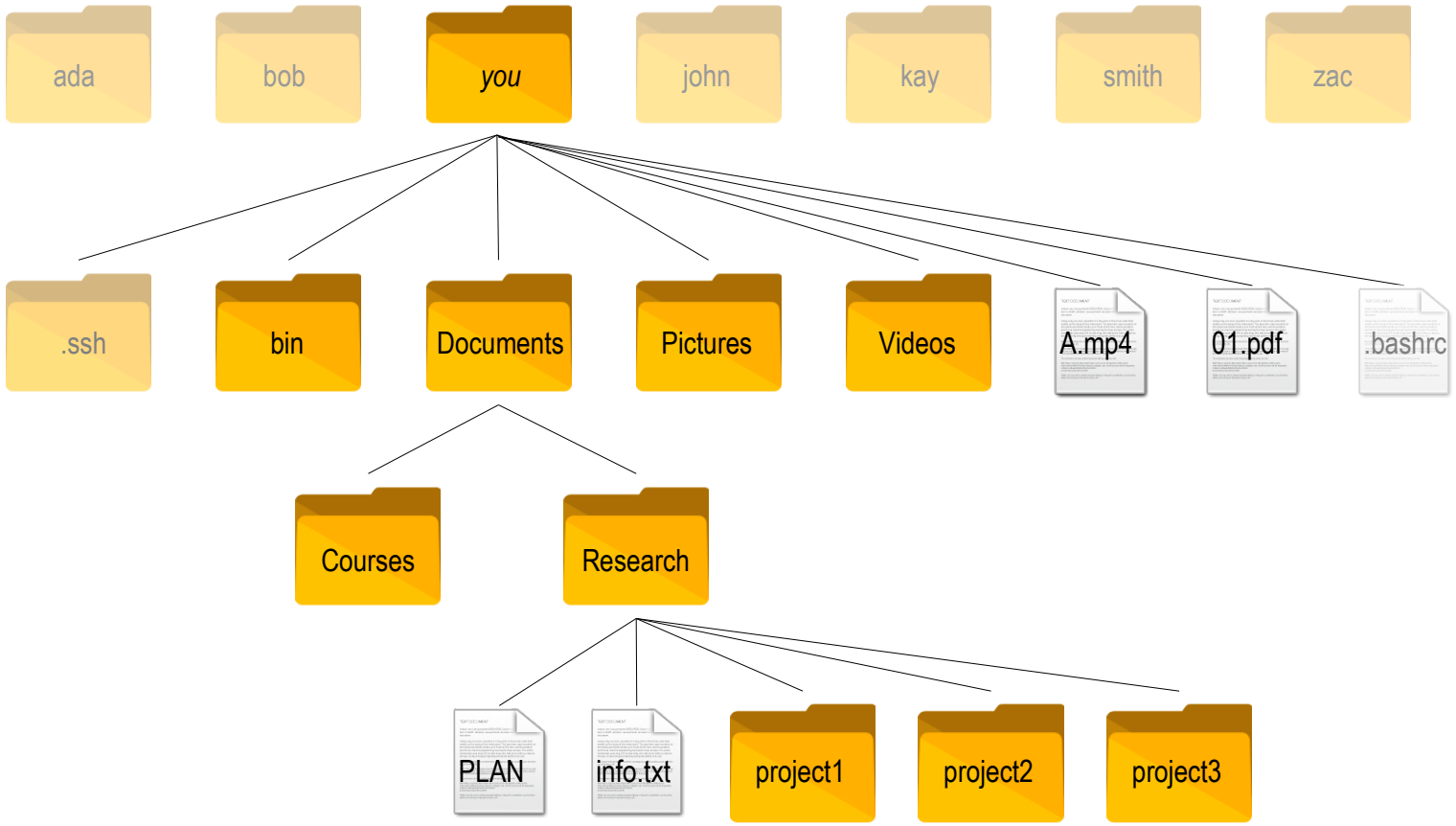
Working with Files and Folders

Your files are stored on file systems. There are three file systems in SHARCNET you will care: /home/you, /work/you and /scratch/you.



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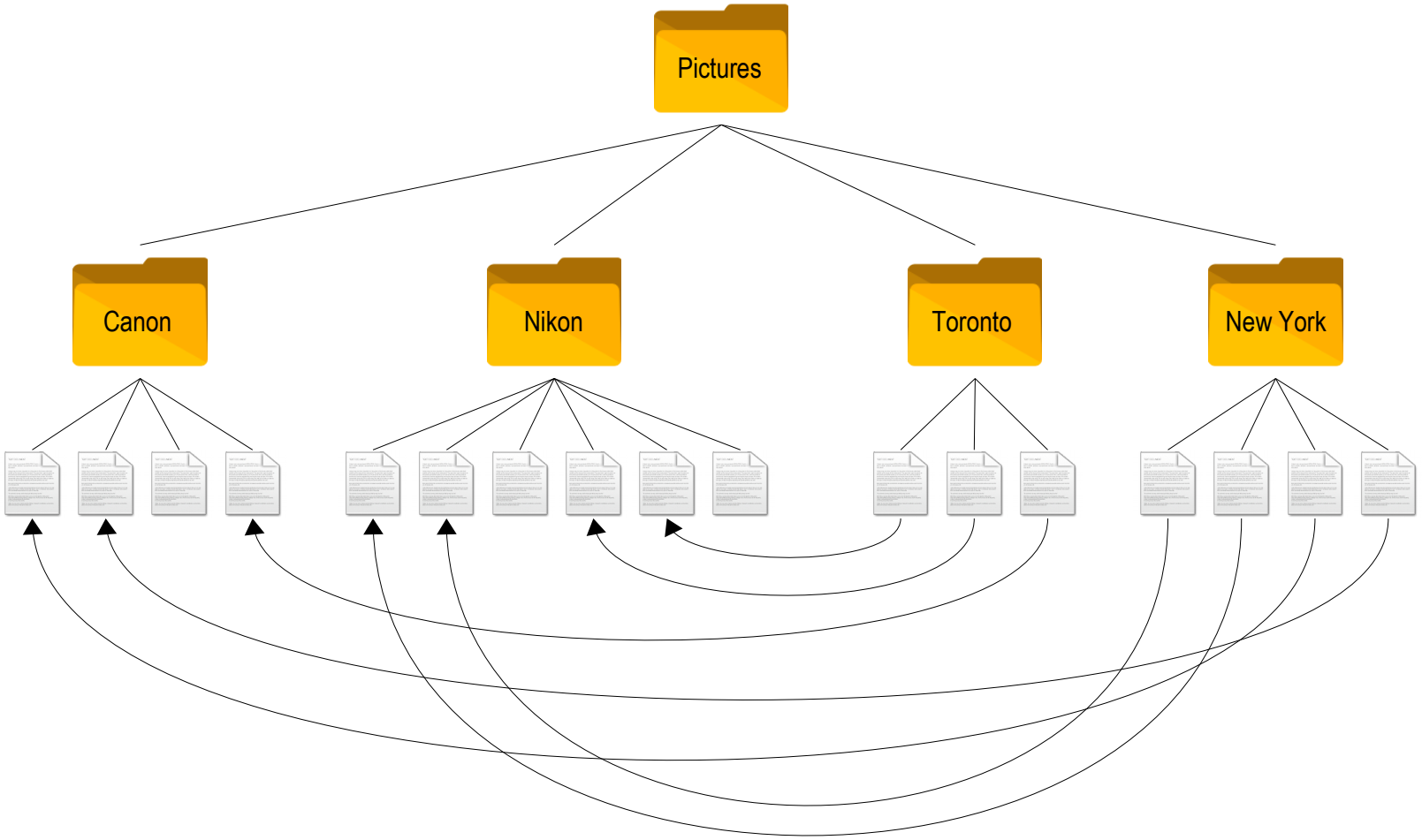
Use symbolic links to avoid duplicating files: we save original files, make "copies" by creating links to the original copies, rather than duplicating the content.



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Example: Creating symbolic links

```
cd Pictures
# When creating a folder name containing a space
# use back slash followed by a space
mkdir Toronto New\ York

cd Toronto
ln -s ../Canon/2015_05_01/* .

cd ../New\ York
ln -s ../Canon/2015_01_01/* .
ln -s ../Nikon/2015_01_01/* .
```

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Commonly used shell commands

- **ls** – to list files and directories.
- **cat** – to concatenate files and print on the standard output.
- **less, more** – to show a file.
- **cmp** – to find two files byte by byte.
- **diff** – to compare tow files line by line.
- **cp** – to copy a file/folder.
- **mv** – to move/rename file/folder.
- **rm** – to remove a file/folder.
- **mkdir** – to create a folder
- **rmdir** – to remove a folder.
- **chmod** – to change the access permission.
- **vi**, **nano**, **emacs**, **gedit**, etc. – create and editing files.

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Pipes and Filters

We will see three (or more) common tasks accomplished by using shell commands:

- Counting lines, words and bytes of a file.
- Extracting a column from a well formatted tabulated data file.
- Extracting lines from certain range from a file.
- Saving the output of a command into a file.
- Automating simple tasks by combining commands.

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Example: Change upper case letters to lower ones in a text file:

```
2012-11-05,DEER
2012-11-05,RABBIT
2012-11-05,RACCOON
2012-11-06,RABBIT
2012-11-06,DEER
2012-11-06,FOX
2012-11-07,RABBIT
2012-11-07,BEAR
```

Before

```
tr [A-Z] [a-z] < ANIMALS.txt
```

```
2012-11-05,deer
2012-11-05,rabbit
2012-11-05,raccoon
2012-11-06,rabbit
2012-11-06,deer
2012-11-06,fox
2012-11-07,rabbit
2012-11-07,bear
```

After

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Example: Extract cities in Ontario from **cities.txt** and sort by population

```
Toronto,Ontario,5583064,1
Montréal,Quebec,3824221,2
Vancouver,British Columbia,2313328,3
Ottawa,Ontario,1236324,4
Calgary,Alberta,1214839,5
Edmonton,Alberta,1159869,6
Québec City,Quebec,765706,7
Winnipeg,Manitoba,730018,8
Hamilton,Ontario,721053,9
Kitchener-Cambridge-Waterloo,Ontario,477160,10
London,Ontario,474786,11
St. Catharines-Niagara,Ontario,392184,12
Halifax,Nova Scotia,390328,13
Oshawa,Ontario,356177,14
Victoria,British Columbia,344615,15
Windsor,Ontario,319246,16
Saskatoon,Saskatchewan,260600,17
Regina,Saskatchewan,210556,18
```

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Example: Extract cities in Ontario (cont'd)

We now put the commands all together to accomplish this task

```
grep -i ontario cities.txt | cut -d ',' -f 1,3 | sort -k 2 -t ',' -n
```

The first command with **grep** outputs only the lines that contains Ontario. It then pipes the output as the input to the second command **cut**.

The command cut filters out the first and third fields and outputs the city and population columns (to the standard out).

The third command **sort** takes output from the previous command cut ans input and sort by the second field (with option -k 2) in a reverse order (with option -n). The option -t ',' specifies the field separator.

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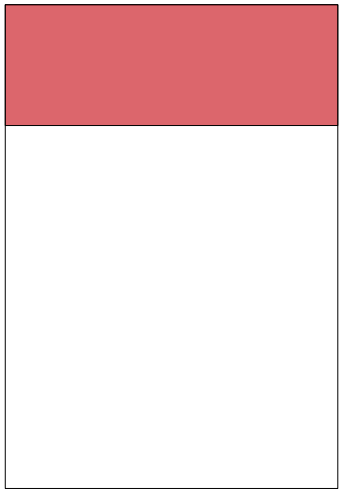
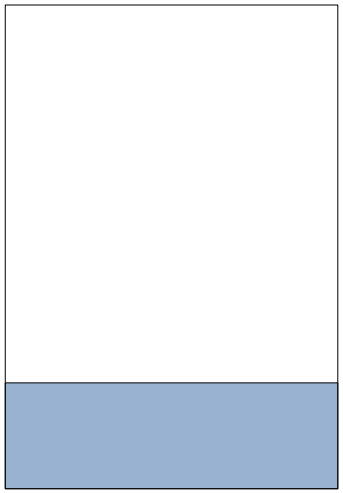
Example: Extracting first and last number of lines from a file.

head -n *m*





tail -n *n*

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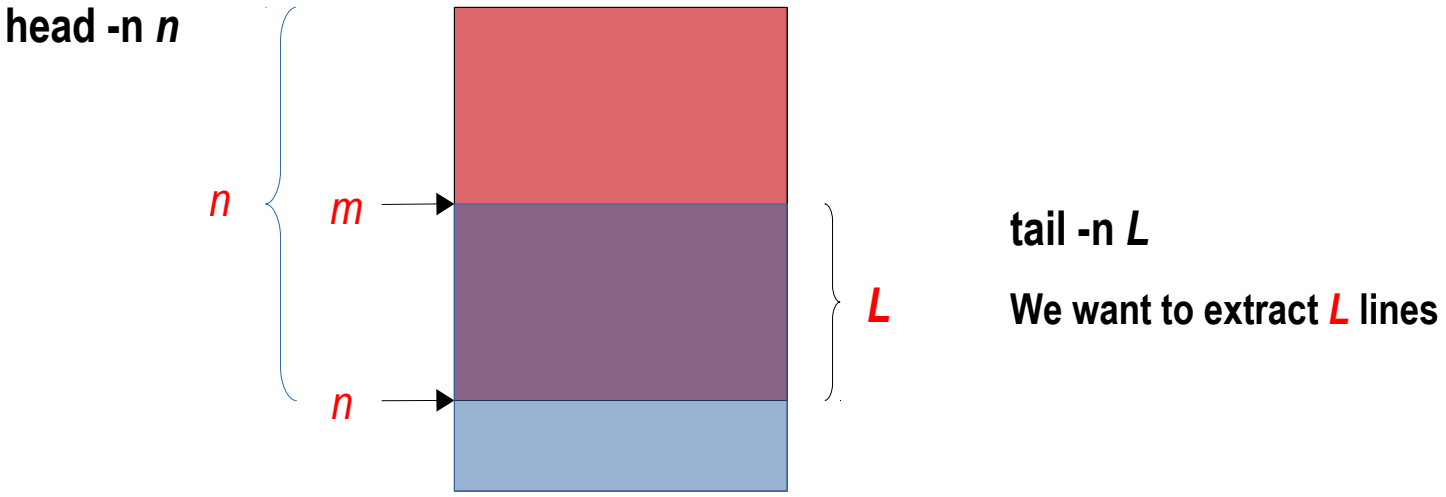
Example: Extracting lines from certain range from a file using combined commands head and tail.



$L = n - m$

head -n *n* … tail -n *L* ?

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Commonly used shell commands

- **wc** – to count lines, words and bytes of a file.
- **cut** – to extract column(s) from a file by delimiters.
- **tr** – to translate or delete characters.
- **sort** – to sort a file by rules.
- **uniq** – to report or omit repeated lines.
- **head** – to print the first N lines of a file.
- **tail** – to print the last N lines of a file.

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Loops

Common tasks

- Repeating tasks by looping over control variables, e.g n=1,2...
- Repeating tasks by looping over list elements.

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Example of loops:

```
# For loops
for ((i=0;i<10;i++)); do
    echo $i
done

list="a b c d"
for e in $list; do
    echo $e
done

for f in *; do
    echo $f
done

# While loops
n=10
i=$n
while [ $i -gt 0 ]; do
    echo $i;
    i=$((i-1));
done
```

Example: Read a file containing multiple lines of records in a loop and process one at a time.

```
input="animal.txt"
BAKIFS=$IFS
IFS=$(echo -en "\n\b")
cat $input | while read line; do
    animal=`echo $line | cut -d',' -f2`
    echo $animal
done
IFS=$BAKIFS
```

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Example: Organizing phone photos into folders by shooting date.

Before

```
[bge@parrot:~/Documents/teaching/bash/exercises/phone] dir
IMG_20150101_000120.jpg  IMG_20150206_070150.jpg  IMG_20150410_064001.jpg
IMG_20150101_000237.jpg  IMG_20150206_070422.jpg  IMG_20150410_064011.jpg
IMG_20150101_000251.jpg  IMG_20150209_160518.jpg  IMG_20150608_172050.jpg
IMG_20150113_071752.jpg  IMG_20150209_160525.jpg  IMG_20150608_172109.jpg
IMG_20150113_113728.jpg  IMG_20150221_143202.jpg  IMG_20150608_181324.jpg
IMG_20150120_071809.jpg  IMG_20150227_174437.jpg  IMG_20150608_185905.jpg
IMG_20150120_071815.jpg  IMG_20150306_074007.jpg  IMG_20150724_084733.jpg
IMG_20150128_071353.jpg  IMG_20150306_144429.jpg  IMG_20150819_145203.jpg
IMG_20150128_071517.jpg  IMG_20150306_144621.jpg  IMG_20150819_145218.jpg
...
```

After

```
[bge@parrot:~/Documents/teaching/bash/exercises/phone] dir
2015_01_01  2015_01_28  2015_02_21  2015_03_08  2015_07_24
2015_01_13  2015_02_06  2015_02_27  2015_04_10  2015_08_19
2015_01_20  2015_02_09  2015_03_06  2015_06_08
```

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Example: Organizing phone photos into folders by shooting date (cont'd).

```
for f in IMG*.jpg; do
    file_date=${f:4:8}   # Extract the date string
    yy=${file_date:0:4}  # Extract the year part
    mm=${file_date:4:2}  # Extract the month part
    dd=${file_date:6:2}  # Extract the date part
    d=${yy}_${mm}_${dd}  # Rebuild the date string
    mkdir $d
    echo "Moving $f to $d"
    mv $f $d
done
```

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Shell Scripts

Putting tasks together in a file to execute

- Putting commands together – simplest case.
- Putting together flow control with shell programming constructs – if-else, loops, etc.

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Example: Organizing phone photos into folders by shooting date.

```
#!/bin/bash
# 'photosort' - Reorganize photos by shooting dates
for f in IMG*.jpg; do
    # Get the shooting date from file name
    file_date=${f:4:8}  # Extract the date string
    yy=${file_date:0:4} # Extract the year part
    mm=${file_date:4:2} # Extract the month part
    dd=${file_date:6:2} # Extract the date part
    d=${yy}_${mm}_${dd} # Rebuild the date string
    # Create the folder if not present
    if [ ! -d $d ]; then
        mkdir $d
    fi
    echo "Moving $f to $d"
    mv $f $d
done
```

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Example: Organizing phone photos into folders by shooting date (cont'd).

```
# Change the permission mode of the file, make the script executable
chmod photosort

# Go to the folder containing the images
cd Pictures/Huawei

# Run the script (“./” means the script is in the current folder)
./photoshort
```