

Unix workshop: The Basics

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Introduction

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POSIX, SUS — standardisation of API and environment between Unix systems

- (almost) everything is a file
- single tree (no concepts of multiple drives)
- top is / (root directory)

Standard directories (where's the thing for that thing)

- `/bin` — binaries essential for the system (used by everyone)
- `/sbin` — binaries for managing the system (usually for `sysadmin`)
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- `/usr/include` — header files (`.h`)
- `/tmp` — temporary storage (cleaned up at boot)
- `/dev` — device files (`tty0`, `lp0`, `hda`)
- `/mnt` — other filesystems (another partition, hard drive, CD-rom)

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- /home — home directories of users
 - /home/user1
 - /home/user2
 - ...

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- . is the current directory
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e.g. `/usr/lib/.` is another name for `/usr/lib`
and `/usr/lib/..` is another name for `/usr`

The Prompt

- command line interface
- scriptable — automation
- short commands for fast entry
- managed by a *shell*
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- `bash` has tab-complete — please use it :-)

Filesystem commands

echo

echoes arguments to stdout
this is built-in to bash, but /bin/echo also exists

```
$ ls          # what's in the current directory?
test.c       test.h
note         contrib/
```

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$ ls          # what's in the current directory?
test.c       test.h
note         contrib/
$ ls contrib  # what's in contrib/ ?
data.txt
$
```

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data.txt
$
```

list files and directories

options:

- -a : all files (including hidden files)
- -l : long format (shows extra information)

In Unix, hidden files are any files that begin with a dot.
e.g.

- .
- ..
- .bashrc
- .vimrc
- .git/

usually used for configuration

```
$ cd contrib # change directory
$ ls
data.txt
$ pwd      # path to working directory
/home/user1/project/contrib
$
```

```
$ cd .. # go back up to /home/user1/project
```

```
$ cd .. # go back up to /home/user1/project  
$ mkdir data  
$ cd data
```



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$ cd .. # go back up to /home/user1/project  
$ mkdir data  
$ cd data  
$ ls  
$ # it's empty  
make a directory
```

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$ mkdir data
$ cd data
$ ls
$ # it's empty
```

make a directory

options:

- -p : make any parents as well
 mkdir -p a/b/c

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$ touch more_data.txt
```

touch, redirection, cat

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$ ls  
more_data.txt
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more_data.txt
```

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$ cat more_data.txt # new file is empty
```

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$ ls
more_data.txt
$ cat more_data.txt # new file is empty
$ echo "Some data" > more_data.txt
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Some data
$ echo "Extra data" > extra_data.txt
```


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Some data
$ echo "Extra data" > extra_data.txt
$ ls
more_data.txt      extra_data.txt
```

touch, redirection, cat

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$ echo "Some data" > more_data.txt
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Some data
$ echo "Extra data" > extra_data.txt
$ ls
more_data.txt      extra_data.txt

touch creates a file if it doesn't exist or updates timestamp of file
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touch creates a file if it doesn't exist or updates timestamp of file
cat outputs contents of files

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$ cat more_data.txt # new file is empty
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$ cat more_data.txt
Some data
$ echo "Extra data" > extra_data.txt
$ ls
more_data.txt      extra_data.txt
```

`touch` creates a file if it doesn't exist or updates timestamp of file
`cat` outputs contents of files (Be careful with binary files. They can mess up your terminal. Use `reset` to fix that.)

```
$ cp more_data.txt more_data.txt.old  
# copy file
```

```
$ cp more_data.txt more_data.txt.old
```

```
# copy file
```

```
$ ls
```

```
more_data.txt      extra_data.txt      more_data.txt.old
```

```
$ cp more_data.txt more_data.txt.old
# copy file
$ ls
more_data.txt    extra_data.txt    more_data.txt.old
$ mv extra_data.txt more_data.txt.old
# move/rename file
```

```
$ cp more_data.txt more_data.txt.old
# copy file
$ ls
more_data.txt    extra_data.txt    more_data.txt.old
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# move/rename file
$ ls
more_data.txt    more_data.txt.old
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$ cp more_data.txt more_data.txt.old
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$ mv extra_data.txt more_data.txt.old
# move/rename file
$ ls
more_data.txt      more_data.txt.old
```

options for cp:

- -p : preserve timestamp
- -r, -R : recursively copy (needed for directories)

My own habit for copying directories is to use `cp -puvR`.

```
$ cd ..
```

```
$ cd ..  
$ ls  
test.c      test.h  
note        contrib/  
data/
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```
$ cd ..  
$ ls  
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data/  
$ rm note
```

```
$ cd ..  
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note        contrib/  
data/  
$ rm note  
$ ls  
test.c      test.h  
contrib/    data/
```



```
$ rm data/*  
# use wildcard to remove all files inside  
$ ls data  
$ rmdir data # remove empty directory  
$ ls  
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# use wildcard to remove all files inside  
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test.c      test.h      contrib/  
$ rm -R contrib
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# use wildcard to remove all files inside  
$ ls data  
$ rmdir data # remove empty directory  
$ ls  
test.c      test.h      contrib/  
$ rm -R contrib  
$ ls  
test.c      test.h
```

```
$ rm data/*  
# use wildcard to remove all files inside  
$ ls data  
$ rmdir data # remove empty directory  
$ ls  
test.c      test.h      contrib/  
$ rm -R contrib  
$ ls  
test.c      test.h
```

options for rm:

- -r, -R : recursively delete (needed for directories)

I use -R instead of -r because it stands out more. There is no built-in trash can in Unix.

```
$ du  
[... outputs file sizes  
for the current directory ... ]  
$ df  
[... outputs disk info ... ]
```

Documentation

```
$ man ls  
[ documentation for ls ]  
$ man printf  
[ documentation for the printf command ]  
$ man 3 printf  
[ documentation for printf() in stdio.h ]  
$ man man
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man pages have a standard layout to make navigating them easier
Some commands are shell built-ins. Use `help` to see the documentation for these

```
$ ls -a    # short option
```


Conventions

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$ ls -a      # short option  
$ ls -la     # short options can be combined  
$ ls -l -a   # or separate  
$ ls --all   # long options have two hyphens  
$ ls --all --full-time # must be separate
```

Most commands display their usage if you use a help option:
-help, -h, or -?

Access control

- root user (admin)

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- su, sudo (change user)

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- whoami (who is the current user?)

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- su, sudo (change user)
- whoami (who is the current user?)
- w (who is logged in?)

- groups (get the groups of a user)

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Permissions

- Each file is owned by a single user and a single group
- shown in `ls -l` listing

Permissions

- Each file is owned by a single user and a single group
- shown in `ls -l` listing
- we can set the group that a file belongs to

```
$ chgrp mygroup project.txt
```

- Three kinds of permissions
 - r — read
 - w — write
 - x — execute

- Three kinds of permissions
 - r — read
 - w — write
 - x — execute
- we can set these settings for the owner of the file, the group the file is in, and anyone else

Permissions

```
$ ls -l this_needs_to_execute  
-r----- 1 user1 group1 this_needs_to_execute
```


Permissions

```
$ ls -l this_needs_to_execute  
-r----- 1 user1 group1 this_needs_to_execute  
$ chmod u+x this_needs_to_execute # user
```

Permissions

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$ ls -l this_needs_to_execute
-r----- 1 user1 group1 this_needs_to_execute
$ chmod u+x this_needs_to_execute # user
$ chmod g+rx this_needs_to_execute # group
```

Permissions

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$ chmod o+rx this_needs_to_execute # other
```

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$ chmod o+rx this_needs_to_execute # other
$ ls -l this_needs_to_execute
-r-xr-xr-x 1 user1 group1 this_needs_to_execute
```

Next time

- processes
- more on I/O redirection
- screen (terminal multiplexer)
- advanced scripting
- network