

# Ten Steps to Linux Survival

## Bash for Windows People

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<https://github.com/dullroar/ten-steps-to-linux-survival/releases>



Figure 1: Merv sez, "Don't panic."

# Step -1 Overview

- Step 0 - Some History

# Ten Steps

- Step 0 - Some History
- Step 1 - Come Out of Your Shell

# Ten Steps

- Step 0 - Some History
- Step 1 - Come Out of Your Shell
- Step 2 - File Under “Directories”

# Ten Steps

- Step 0 - Some History
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- Step 3 - Finding Meaning

# Ten Steps



- Step 0 - Some History
- Step 1 - Come Out of Your Shell
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- Step 4 - Grokking grep

# Ten Steps

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- Step 0 - Some History
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- Step 4 - Grokking grep
- Step 5 - “Just a Series of Pipes”

# Ten Steps

- Step 0 - Some History
- Step 1 - Come Out of Your Shell
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- Step 3 - Finding Meaning
- Step 4 - Grokking grep
- Step 5 - “Just a Series of Pipes”
- Step 6 - vi

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- Step 4 - Grokking grep
- Step 5 - “Just a Series of Pipes”
- Step 6 - vi
- Step 7 - The Whole Wide World

# Ten Steps

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- Step 6 - vi
- Step 7 - The Whole Wide World
- Step 8 - The Man Behind the Curtain

# Ten Steps

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- Step 9 - How Do You Know What You Don’t Know, man?

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- Step 10 - And So On

# Step 0 Some History



# Remember ONE Thing!

There is **no such thing** as “UNIX”

# Remember ONE Thing!

There is **no such thing** as “UNIX”  
...and that matters!

# Step 1

# Come Out of Your Shell

# What is a shell?

Windows has a shell.  
Two, in fact:

- CMD.EXE

# What is a shell?

Windows has a shell.  
Two, in fact:

- CMD.EXE
- PowerShell.EXE

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# What is a shell?

Windows has a shell.

Two, in fact:

- CMD.EXE
- PowerShell.EXE

Technically, Windows Explorer is a “shell” for the GUI environment.



# “UNIX” has **lots** of shells

- **sh** - Bourne shell

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  - **ash** - Almquist shell

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    - **dash** - Debian Almquist shell

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  - **bash** - “Bourne-again” shell

# “UNIX” has **lots** of shells

- **sh** - Bourne shell
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    - **dash** - Debian Almquist shell
  - **bash** - “Bourne-again” shell
  - **ksh** - Korn shell

# “UNIX” has **lots** of shells

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  - **zsh** - Z shell

# “UNIX” has **lots** of shells

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    - **dash** - Debian Almquist shell
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  - **ksh** - Korn shell
  - **zsh** - Z shell
- **csh** - C shell

# “UNIX” has **lots** of shells

- **sh** - Bourne shell
  - **ash** - Almquist shell
    - **dash** - Debian Almquist shell
  - **bash** - “Bourne-again” shell
  - **ksh** - Korn shell
  - **zsh** - Z shell
- **csh** - C shell
- ***and many more!***



# Typically bash

# Linux default shell

# Comparing CMD.EXE and bash

## set in bash

```
~ $ set
```

```
BASH=/bin/bash
```

```
BASHOPTS=checkwinsize:cmdhist:complete_fullquote:...
```

```
BASH_ALIASES=()
```

```
BASH_ARGC=()
```

```
BASH_ARGV=()
```

```
BASH_CMDS=()
```

```
...and so on...
```

## set in CMD.EXE

```
C:\Users\myuser>set
```

```
ALLUSERSPROFILE=C:\ProgramData
```

```
APPDATA=C:\Users\myuser\AppData\Roaming
```

```
CommonProgramFiles=C:\Program Files\Common Files
```

```
CommonProgramFiles(x86)=C:\Program Files (x86)\Common Files
```

```
CommonProgramW6432=C:\Program Files\Common Files
```

```
COMPUTERNAME=JLEHMER650
```

```
...and so on...
```

**bash:**

```
~ $ echo $HOME  
/home/myuser
```

**CMD.EXE:**

```
C:\> echo %homepath%  
\Users\myuser
```

# Similar, but different

- `$variable` (bash) vs. `%variable%` (CMD.EXE)

# Similar, but different

- `$variable` (bash) vs. `%variable%` (CMD.EXE)
- bash is case-sensitive, CMD.EXE is not

# Product of your environment



# Setting variables

```
~ $ FOO=myval /home/myuser/myscript
~ $ CURRDATE=`date`
~ $ echo $CURRDATE
Wed Oct 28 11:43:38 CDT 2015
```

# A path! A path!

```
$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:...
```

- Tab expansion

# Getting lazy

# Getting lazy

- Tab expansion
- Command history

# Step 2

# File under “Directories”

# ls - list files

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```
~ $ ls
```

Audiobooks	Downloads	KindleGen	Podcasts	Templates
Desktop	Dropbox	Music	Public	Videos
Documents	FreeRDP	Pictures	Temp	VSCode-linux-x64

# “Dotfiles”

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```
~ $ ls -a
.      .dmrc      .gnome2_private  Pictures  .themes
..     Documents  .hplip           .pki      .thumbnails
.adobe Downloads    .hugin          Podcasts  .thunderbird
.atom  .dropbox    .ICEauthority   .profile  Videos
Audiobooks  Dropbox     .icons          .ptbt1    .vscode
.bash_history .dropbox-dist  KindleGen      Public    VSCode-linux-x64
.bash_logout .face         .lastpass      .sbd      .wine
.cache       FreeRDP       .lessht        .ssh      .Xauthority
.cinnamon   .gconf        .linuxmint     .swp      .xinputrc
.cmake       .gimp-2.8     .local         Temp       .xsession-errors
.config      .gitconfig    .macromedia    Templates
.dbus        .gksu.lock    .mozilla       .texmf-var
Desktop     .gnome2       Music          .TeXworks
```



## List details

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```
~ $ ls -l
```

```
total 92
```

```
drwxr-xr-x  2 myuser mygroup      4096 Sep  7 04:16 Desktop
drwxr-xr-x  2 myuser mygroup      4096 Oct 13 10:02 Documents
drwxr-xr-x  2 myuser mygroup      4096 Oct 14 09:45 Downloads
drwx----- 8 myuser mygroup      4096 Oct 16 19:58 Dropbox
drwxr-xr-x 19 myuser mygroup      4096 Oct 12 09:48 FreeRDP
-rwxr-x---  1 myuser sambashare    883 Oct 12 11:34 installrdp
drwxr-xr-x  5 myuser mygroup      4096 Oct 16 10:47 LightTable
drwxr-xr-x  2 myuser mygroup      4096 Sep  7 04:16 Music
drwxr-xr-x  3 myuser mygroup     36864 Oct 12 17:29 Pictures
drwxr-xr-x  2 myuser mygroup      4096 Sep  7 04:16 Public
-rwxr-xr-x  1 myuser mygroup       816 Oct 15 18:00 rdp
```

```
...and so on...
```

## Combining parameters

```
$ ls -al
```

```
total 344
```

```
drwxr-xr-x 40 myuser mygroup      4096 Oct 17 07:14 .
drwxr-xr-x  3 root    root        4096 Sep  7 04:09 ..
drwx----- 3 myuser mygroup      4096 Sep  7 09:33 .adobe
drwxr-xr-x  5 myuser mygroup      4096 Oct 12 15:48 .atom
-rw-----  1 myuser mygroup      6428 Oct 17 06:11 .bash_history
-rw-r--r--  1 myuser mygroup        220 Sep  7 04:09 .bash_logout
drwx----- 18 myuser mygroup      4096 Oct 13 07:31 .cache
drwxr-xr-x  5 myuser mygroup      4096 Oct 16 19:57 .cinnamon
drwxr-xr-x  3 myuser mygroup      4096 Oct 12 09:45 .cmake
drwxr-xr-x 26 myuser mygroup      4096 Oct 15 10:23 .config
drwx-----  3 myuser mygroup      4096 Sep  7 04:16 .dbus
...and so on...
```

- **Short**

# Parameter types

# Parameter types

- **Short**

- `rm -rf *`

# Parameter types

- **Short**
  - `rm -rf *`
  - Easier to type

# Parameter types

- **Short**
  - `rm -rf *`
  - Easier to type
- **Long**

# Parameter types

- **Short**

- `rm -rf *`
- Easier to type

- **Long**

- `rm --recursive --force *`

# Parameter types

- **Short**

- `rm -rf *`
- Easier to type

- **Long**

- `rm --recursive --force *`
- Easier to understand



## cat - concatenate files

```
~ $ cat installrdp
#!/bin/bash
sudo apt-get -y install git
cd ~
git clone git://github.com/FreeRDP/FreeRDP.git
cd FreeRDP
sudo apt-get -y install build-essential git-core cmake libssl-dev \
    libx11-dev libxext-dev libxinerama-dev libxcursor-dev libxdamage-dev \
    libxv-dev libxkbfile-dev libasound2-dev libcups2-dev libxml2 \
    libxml2-dev libxrandr-dev libgstreamer0.10-dev \
    libgstreamer-plugins-base0.10-dev libxi-dev \
    libgstreamer-plugins-base1.0-dev libavutil-dev libavcodec-dev \
    libcunit1-dev libdirectfb-dev xmlto doxygen libxtst-dev
cmake -DCMAKE_BUILD_TYPE=Debug -DWITH_SSE2=ON .
make
...and so on...
```

## tail - show end of files

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```
~ # tail dmesg
```

```
[ 2.774931] loop: module loaded
[ 3.349880] eth0: intr type 3, mode 0, 3 vectors allocated
[ 3.351331] eth0: NIC Link is Up 10000 Mbps
[ 3.422647] RPC: Registered named UNIX socket transport module.
[ 3.422649] RPC: Registered udp transport module.
[ 3.422650] RPC: Registered tcp transport module.
[ 3.422651] RPC: Registered tcp NFSv4.1 backchannel transport module.
[ 3.432437] FS-Cache: Loaded
[ 3.443980] FS-Cache: Netfs 'nfs' registered for caching
[ 3.449794] Installing knfsd (copyright (C) 1996 okir@monad.swb.de).
```

## “Follow” a file

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```
~ # tail -f dmesg
[ 2.774931] loop: module loaded
[ 3.349880] eth0: intr type 3, mode 0, 3 vectors allocated
[ 3.351331] eth0: NIC Link is Up 10000 Mbps
[ 3.422647] RPC: Registered named UNIX socket transport module.
[ 3.422649] RPC: Registered udp transport module.
[ 3.422650] RPC: Registered tcp transport module.
[ 3.422651] RPC: Registered tcp NFSv4.1 backchannel transport module.
[ 3.432437] FS-Cache: Loaded
[ 3.443980] FS-Cache: Netfs 'nfs' registered for caching
[ 3.449794] Installing knfsd (copyright (C) 1996 okir@monad.swb.de).
...new lines will appear here over time...
```

# sort - sorting files

```
~ $ sort -k 3 -n * | tail -n 3
```

```
Combine motor      1500
```

```
Tractor tires     2000
```

```
Combine tires     2500
```

# cp - copy files

```
~ $ cp diary.txt diary.bak  
~ $ cp -r thisdir thatdir  
~ $ cp --recursive thisdir thatdir
```

# mv - move files

```
~ $ mv thismonth.log lastmonth.log
```

- mv is simple rename

## mv - move files

```
~ $ mv thismonth.log lastmonth.log
```

- mv is simple rename
- rename offers more options

# rm - remove files

```
~ $ rm desktop.ini
```



# Danger, Will Robinson!

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```
~ $ cd MyDissertation
```

```
~ $ ls
```

```
Citations.bak  Citations.doc  Dissertation.bak  Dissertation.doc  Notes.doc
```

```
~ $ rm * .bak
```

```
rm: cannot remove ‘.bak’: No such file or directory
```

```
~ $ ls
```

And all was null and void...

```
~ $ rm -rf *
```

## touch - update file time

```
~ $ touch NewEmptyDissertation.doc
```

```
~ $ ls -l
```

```
total 0
```

```
-rw-rwxr--+ 1 myuser mygroup 0 Oct 19 14:12 NewEmptyDissertation.doc
```

# Reset file time

```
~ $ touch -t 201412242300 NewEmptyDissertation.doc
```

```
~ $ ls -l
```

```
total 0
```

```
-rw-rwxr--+ 1 myuser mygroup 0 Dec 24  2014 NewEmptyDissertation.doc
```

# mkdir - make directory

```
~ $ mkdir Bar
```

```
~ $ ls
```

```
Bar
```

# cd - change directory

```
~ $ cd /etc
~ $ pwd
/etc
```

# Absolute paths

- Always includes the root, /

## Absolute paths

- Always includes the root, /
- cd /etc



# Relative paths

- Starts from current directory, `.`

# Relative paths

- Starts from current directory, .
- Parent directory is ..

# Relative paths

- Starts from current directory, .
- Parent directory is ..
- `cd child`

# Relative paths

- Starts from current directory, .
- Parent directory is ..
- `cd child`
- `cd ../sibling`

- . - current directory

. and ..

- . - current directory

. and ..

# . and ..

- . - current directory
  - we will see why this is useful later

# . and ..

- . - current directory
  - we will see why this is useful later
- .. - parent directory



# . and ..

- . - current directory
  - we will see why this is useful later
- .. - parent directory

. and ..

- . - current directory
  - we will see why this is useful later
- .. - parent directory
  - useful to navigate “up and out”

# May I?

- **3x3 “grid”** - who by what?

# May I?

- **3x3 “grid”** - who by what?
- **UGO** - who?

# May I?

- **3x3 “grid”** - who by what?
- **UGO** - who?
- **RWX** - what?

# Who?

- **U** - primary *user* or “owner”

# Who?

- **U** - primary *user* or “owner”
- **G** - primary *group*

# Who?

- **U** - primary *user* or “owner”
- **G** - primary *group*
- **O** - other (everyone else)



- **R** - *read* permission

# What?

# What?

- **R** - *read* permission
- **W** - *write* permission

# What?

- **R** - *read* permission
- **W** - *write* permission
- **X** - *execute* permission

# What?

- **R** - *read* permission
- **W** - *write* permission
- **X** - *execute* permission

# What?

- **R** - *read* permission
- **W** - *write* permission
- **X** - *execute* permission
  - “list directory” permission

## ls -l, again

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```
~ $ ls -l
```

```
total 92
```

```
drwxr-xr-x  2 myuser mygroup    4096 Sep  7 04:16 Desktop
drwxr-xr-x  2 myuser mygroup    4096 Oct 13 10:02 Documents
drwxr-xr-x  2 myuser mygroup    4096 Oct 14 09:45 Downloads
drwx----- 8 myuser mygroup    4096 Oct 16 19:58 Dropbox
drwxr-xr-x 19 myuser mygroup    4096 Oct 12 09:48 FreeRDP
-rwxr-x---  1 myuser sambashare  883 Oct 12 11:34 installrdp
drwxr-xr-x  5 myuser mygroup    4096 Oct 16 10:47 LightTable
drwxr-xr-x  2 myuser mygroup    4096 Sep  7 04:16 Music
drwxr-xr-x  3 myuser mygroup   36864 Oct 12 17:29 Pictures
drwxr-xr-x  2 myuser mygroup    4096 Sep  7 04:16 Public
-rwxr-xr-x  1 myuser mygroup     816 Oct 15 18:00 rdp
```

```
...and so on...
```

- - - file

- rWXr-Xr-X

-rwxr-xr-x

- - - file
- rwx - myuser can read, write and execute



- - - file
- rwx - myuser can read, write and execute
- r-x - mygroup and anyone else can read and execute

- d - directory

drwx-----

drwx-----

- d - directory
- rwx - myuser can read, write and list contents

drwx-----

- d - directory
- rwx - myuser can read, write and list contents
- --- - no one else can do anything

# Changing owners

- `chown myuser foo` - change owner of foo to user myuser

# Changing owners

- `chown myuser foo` - change owner of foo to user myuser
- `chgrp mygroup bar` - change group for bar to mygroup

## Changing access

- `chmod u+rw foo` - give primary owner read/write to foo

# Changing access

- `chmod u+rw foo` - give primary owner read/write to `foo`
- `chmod o-x bar` - remove execute permission for “others” from `bar`



# Will this be on the test?

If `rx` were octal:

- `rx == 22 (4)`

# Will this be on the test?

If `rx` were octal:

- `r == 22 (4)`
- `w == 21 (2)`

# Will this be on the test?

If `rx` were octal:

- `r == 22 (4)`
- `w == 21 (2)`
- `x == 20 (1)`

# Will this be on the test?

If `rx` were octal:

- `r == 22 (4)`
- `w == 21 (2)`
- `x == 20 (1)`
- `- == 0`

# Olde Skool chmod

Then `chmod 754 foo`:

- `7 = rwx` for user

Quicker than `chmod u=rwx,g=rx,o=r foo`

# Olde Skool chmod

Then `chmod 754 foo`:

- 7 = `rwX` for user
- 5 = `r-X` for group

Quicker than `chmod u=rwx,g=rx,o=r foo`

# Olde Skool chmod

Then `chmod 754 foo`:

- 7 = `rwX` for user
- 5 = `r-X` for group
- 4 = `r--` for other

Quicker than `chmod u=rwx,g=rx,o=r foo`

## Why won't it run?

```
~ # echo "echo Hello world" > foo
~ # ls -l
total 4
-rw-r--r-- 1 root root 17 Oct 20 10:07 foo
~ # ./foo
-bash: ./foo: Permission denied
~ # chmod u+x foo
~ # ls -l
total 4
-rwxr--r-- 1 root root 17 Oct 20 10:07 foo
~ # ./foo
Hello world
```



# Compressing files

```
~ $ zip -r foo foo
```

```
updating: foo/ (stored 0%)
```

```
  adding: foo/c (stored 0%)
```

```
  adding: foo/b (stored 0%)
```

```
  adding: foo/d/ (stored 0%)
```

```
  adding: foo/d/e (stored 0%)
```

```
  adding: foo/a (stored 0%)
```

```
~ $ ls -l foo.zip
```

```
-rw-r--r-- 1 myuser mygroup 854 Oct 24 15:56 foo.zip
```

```
~ $ unzip foo
```

```
Archive:  foo.zip
```

```
  extracting: foo/c
```

```
  extracting: foo/b
```

```
  extracting: foo/d/e
```

```
  extracting: foo/a
```

```
~ $ tar cvzf foo.tgz foo
```

```
foo/
```

```
foo/c
```

```
foo/b
```

```
foo/d/
```

```
foo/d/e
```

```
foo/a
```

```
~ $ ls -l foo.tgz
```

```
-rw-r--r-- 1 myuser mygroup 191 Oct 24 16:19 foo.tgz
```

```
~ $ tar xvf foo.tgz
```

```
foo/
```

```
foo/c
```

```
foo/b
```

```
foo/d/
```

```
foo/d/e
```

```
foo/a
```

# Soft links

```
~ $ ln -s d Dee
```

- Equivalent to a shortcut

# Soft links

```
~ $ ln -s d Dee
```

- Equivalent to a shortcut
- Target can be directory or file

# Soft links

```
~ $ ln -s d Dee
```

- Equivalent to a shortcut
- Target can be directory or file
- Target can be any file system

# Soft links

```
~ $ ln -s d Dee
```

- Equivalent to a shortcut
- Target can be directory or file
- Target can be any file system
- Deleting link doesn't affect target

# Soft links

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```
~ $ ln -s d Dee
```

- Equivalent to a shortcut
- Target can be directory or file
- Target can be any file system
- Deleting link doesn't affect target
- Deleting target breaks link, doesn't remove it

# Hard links

~ \$ ln d Dee

- ‘Equivalent to NTFS junction point



# Hard links

~ \$ ln d Dee

- 'Equivalent to NTFS junction point
- Target can be only files

# Hard links

```
~ $ ln d Dee
```

- 'Equivalent to NTFS junction point
- Target can be only files
- Target must be on same file system

# Hard links

~ \$ ln d Dee

- 'Equivalent to NTFS junction point
- Target can be only files
- Target must be on same file system
- File not deleted until **ALL** hard links deleted

# File systems

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```
~ $ df
Filesystem              1K-blocks    Used Available Use% Mounted on
/dev/mapper/mint--vg-root 118647068 28847464  83749608  26% /
none                    4          0          4    0% /sys/fs/cgroup
udev                   1965068     4    1965064    1% /dev
tmpfs                  396216    1568    394648    1% /run
none                   5120       0     5120     0% /run/lock
none                  1981068    840    1980228    1% /run/shm
none                  102400     24     102376    1% /run/user
/dev/sda1              240972    50153    178378   22% /boot
```

# What's the diff?

```
~ $ diff orig.conf new.conf
1c1
< F00=1
---
> F00=2
7d6
< BAR=Xyzzy
```

# Step 3

# Finding Meaning

# find in 3 steps

## 1 Starting at location X



# find in 3 steps

- ① Starting at location *X*
- ② Recursively find all entries that match

## find in 3 steps

- ➊ Starting at location *X*
- ➋ Recursively find all entries that match
- ➌ Do something for each match

## Example

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```
~ $ find //myserver/myshare/logs/000[4-9] -name \*.dat -newer logchecker.csv \  
    -exec /home/myuser/Sandbox/FileCheckers/logchecker \{\} \;
```

① Starting at //myserver/myshare/logs/000[4-9]

## Example

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~ $ find //myserver/myshare/logs/000[4-9] -name \*.dat -newer logchecker.csv \  
    -exec /home/myuser/Sandbox/FileCheckers/logchecker \{\} \;
```

- ① Starting at //myserver/myshare/logs/000[4-9]
- ② Find all files that end in .dat

## Example

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~ $ find //myserver/myshare/logs/000[4-9] -name \*.dat -newer logchecker.csv \  
    -exec /home/myuser/Sandbox/FileCheckers/logchecker \{\} \;
```

- ① Starting at //myserver/myshare/logs/000[4-9]
- ② Find all files that end in .dat
- ③ That are also newer than logchecker.csv

## Example

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```
~ $ find //myserver/myshare/logs/000[4-9] -name \*.dat -newer logchecker.csv \  
    -exec /home/myuser/Sandbox/FileCheckers/logchecker \{\} \;
```

- ① Starting at //myserver/myshare/logs/000[4-9]
- ② Find all files that end in .dat
- ③ That are also newer than logchecker.csv
- ④ Execute logchecker, passing in path to file

# What's with the backslashes?

```
~ $ find //myserver/myshare/logs/000[4-9] -name \*.dat -newer logchecker.csv \  
    -exec /home/myuser/Sandbox/FileCheckers/logchecker \{\} \;
```

Backslashes prevent “shell expansion”

## Useful find tests

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- **-executable** - the file is executable or the directory is searchable
- **-group <gname>** - file belongs to group *gname*
- **-iname <pattern>** - case-insensitive name search
- **-name <pattern>** - case-sensitive name search
- **-newer <file>** - newer than *file*
- **-size <n>** - file uses *n* units of space
  - various measures like 512-byte blocks (b) through gigabytes (G).
- **-type <c>** - file is of type *c*
  - two most common - d (directory) or f (file).
- **-user <uname>** - file is owned by *uname*.



## Useful find actions

- **-delete** - deletes any files matched so far
  - Actions are also tests (predicates)
  - Don't put this first!
- **-exec and -execdir** - executes a command or script
- **-print** - prints the full path of the found file or directory
- **-printf** - prints a formatted string, useful for reports

# find -printf

```
~ $ find . -type f -printf "%p\n%u\n%TY-%Tm-%TdT%TT\n\n"
./a
myuser
2015-10-21T11:02:51.7014527000
```

# Step 4

# Grokking grep

Finds files based on their ***content***

```
~ $ touch a b c
```

```
~ $ echo This sequence of characters is called a \"string\". > d
```

```
~ $ cat d
```

```
This sequence of characters is called a "string".
```

```
~ $ ls
```

```
a  b  c  d
```

```
~ $ grep is *
```

```
d:This sequence of characters is called a "string".
```

## Famous quote

“Some people, when confronted with a problem, think ‘I know, I’ll use regular expressions.’ Now they have two problems.” - *Jamie Zawinski*

# Regular expressions

A “regex” is a pattern for matching strings

- `dir *.txt` - match zero or more characters

# Regular expressions

A “regex” is a pattern for matching strings

- `dir *.txt` - match zero or more characters
- `find //myserver/myshare/logs/000[4-9] -print`



# Regular expressions

A “regex” is a pattern for matching strings

- `dir *.txt` - match zero or more characters
- `find //myserver/myshare/logs/000[4-9] -print`
- `grep is *` - find “is” in all files in current directory

## Helpful regexes

- **one|other** - find one pattern or the other.
- **^** - pattern for the beginning of a line.
- **\$** - pattern for the end of a line.
- **?** - match exactly one character.
- **\*** - match zero or more characters.
- **+** - match one or more characters.
- **[A-Z]** - match any character in a range (such as in this case any uppercase Latin alphabetic character).
- **[n|y]** - match one character or another (such as n or y here).

## Why 2 problems?

What does the following do?

```
(?bhttp://[-A-Za-z0-9+&@#/%?=_()|!:.,;]*[-A-Za-z0-9+&@f
```

- Checks a Web URL for validity

## Why 2 problems?

What does the following do?

```
(?bhttp://[-A-Za-z0-9+&@#/%?=_()|!:.,;]*[-A-Za-z0-9+&@f
```

- Checks a Web URL for validity
- Are you going to remember that?

## Why 2 problems?

What does the following do?

```
(?bhttp://[-A-Za-z0-9+&@#/%?=_()|!:.,;]*[-A-Za-z0-9+&@f
```

- Checks a Web URL for validity
- Are you going to remember that?
- Are you going to be able to figure it out?

# Step 5

# A Series of Pipes

## stdin, stdout, stderr

- **stdin** - input, file descriptor 0
- **stdout** - output, file descriptor 1
- **stderr** - “error” output, file descriptor 2
- All three use the console in interactive mode by default



# Output redirection

```
~ $ echo Hello, world > hw
~ $ ls -l
total 1
-rw-rwxr--+ 1 myuser mygroup 13 Oct 22 10:40 hw
~ $ cat hw
Hello, world
```

# Input redirection

```
~ $ cat < hw  
Hello, world
```

Equivalent to:

```
~ $ cat hw  
Hello, world
```

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```
~ $ find . -exec cat \{\} \;
```

```
cat: .: Is a directory
```

```
This is a
```

```
This is b
```

```
This is c
```

```
cat: ./d: Is a directory
```

```
This is e
```

“Is a directory” is an error message

## Error redirection

```
~ $ find . -exec cat \{\} \; 2>/tmp/finderrors.log
```

```
This is a
```

```
This is b
```

```
This is c
```

```
This is e
```

```
~ $ cat /tmp/finderrors.log
```

```
cat: .: Is a directory
```

```
cat: ./d: Is a directory
```

This is where those “file descriptors” come in

## Logging ALL output to file

```
~ $ find . -exec cat \{\} \; >/tmp/find.log 2>&1
```

```
~ $ cat /tmp/find.log
```

```
cat: .: Is a directory
```

```
This is a
```

```
This is b
```

```
This is c
```

```
cat: ./d: Is a directory
```

```
This is e
```

The 2>&1 trick works in CMD.EXE, too!

# Rewrite vs. append

```
~ $ find . -exec cat \{\} \; >/tmp/find.log
```

VS.

```
~ $ find . -exec cat \{\} \; >>/tmp/find.log
```

# Everyone line up

```
~ $ cat *.txt | tr '\\\ ' '/' | while read line ; do ./mycmd "$line" ; done
```

- ❶ cat echos all .txt files to stdout, piped to...
- ❷ tr translates any backslash characters before sending it into...
- ❸ A while loop that reads each line into a variable called \$line and then calls...
- ❹ Some custom script or program called ./mycmd passing in the value of each \$line.

## Two places at once

```
~ $ find . -name error.log | tee > errorlogs.txt
```

- Log output to error.log



## Two places at once

```
~ $ find . -name error.log | tee > errorlogs.txt
```

- Log output to error.log
- Monitor its progress on the console at the same time

# Step 6

vi

# Why vi?

- Use nano if available

# Why vi?

- Use nano if available
- But vi is (almost) ***always*** there

# Why vi?

- Use nano if available
- But vi is (almost) ***always*** there
- Good to know the basics “just in case”

# vi strangeness

vi is a “modal” editor

- In “command” mode to start

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vi is a “modal” editor

- In “command” mode to start
- Need to go into “insert mode” to insert new text



# vi strangeness

vi is a “modal” editor

- In “command” mode to start
- Need to go into “insert mode” to insert new text
- Confusing to almost everyone at first

# vi commands

- d - “delete”

# vi commands

- d - “delete”
- b - “jump ‘back’ one ‘word’ ”

# vi commands

- d - “delete”
- b - “jump ‘back’ one ‘word’ ”
- i - enter “insert” mode

# vi commands

- d - “delete”
- b - “jump ‘back’ one ‘word’ ”
- i - enter “insert” mode
- ESC - exit “insert” mode

# vi commands

- d - “delete”
- b - “jump ‘back’ one ‘word’ ”
- i - enter “insert” mode
- ESC - exit “insert” mode
- dw - “delete ‘word’ ”

# vi commands

- d - “delete”
- b - “jump ‘back’ one ‘word’ ”
- i - enter “insert” mode
- ESC - exit “insert” mode
- dw - “delete ‘word’ ”
- 3dw - “delete 3 ‘words’ ”

# Get me out of here!

- `:q!` - exit without saving



# Get me out of here!

- `:q!` - exit without saving
- `u` - “undo” command

# Get me out of here!

- `:q!` - exit without saving
- `u` - “undo” command
- `3u` - “undo” last three changes

# Get me out of here!

- `:q!` - exit without saving
- `u` - “undo” command
- `3u` - “undo” last three changes
- `view` - “read-only” version of `vi`

# Navigating

- Arrow and page keys ***tend*** to work right

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  - Except in insert mode!

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- Arrow and page keys **tend** to work right
  - Except in insert mode!
- 0 - jump to beginning of line
- \$ - jump to end of line

# Navigating

- Arrow and page keys **tend** to work right
  - Except in insert mode!
- 0 - jump to beginning of line
- \$ - jump to end of line
- w - jump forward a “word”



# Navigating

- Arrow and page keys **tend** to work right
  - Except in insert mode!
- **0** - jump to beginning of line
- **\$** - jump to end of line
- **w** - jump forward a “word”
- **b** - jump backward a “word”

# Navigating

- Arrow and page keys **tend** to work right
  - Except in insert mode!
- `0` - jump to beginning of line
- `$` - jump to end of line
- `w` - jump forward a “word”
- `b` - jump backward a “word”
- `:0` - jump to beginning of file

# Navigating

- Arrow and page keys **tend** to work right
  - Except in insert mode!
- `0` - jump to beginning of line
- `$` - jump to end of line
- `w` - jump forward a “word”
- `b` - jump backward a “word”
- `:0` - jump to beginning of file
- `G` - jump to end of file

# I've been searching

- `/foo` - find “foo” from cursor forward

# I've been searching

- `/foo` - find “foo” from cursor forward
- `?foo` - find “foo” from cursor backward

# I've been searching

- `/foo` - find “foo” from cursor forward
- `?foo` - find “foo” from cursor backward
- `n` - find next instance of last search

# I've been searching

- `/foo` - find “foo” from cursor forward
- `?foo` - find “foo” from cursor backward
- `n` - find next instance of last search
- `p` - find previous instance of last search

# Insertion

All of the following enter “insert mode”:

- i - at cursor



# Insertion

All of the following enter “insert mode”:

- i - at cursor
- I - at beginning of line

# Insertion

All of the following enter “insert mode”:

- i - at cursor
- I - at beginning of line
- A - “append” at end of line

# Insertion

All of the following enter “insert mode”:

- i - at cursor
- I - at beginning of line
- A - “append” at end of line
- o - insert line below (lowercase) current line

# Insertion

All of the following enter “insert mode”:

- i - at cursor
- I - at beginning of line
- A - “append” at end of line
- o - insert line below (lowercase) current line
- O - insert line above (uppercase) current line

# Insertion

All of the following enter “insert mode”:

- i - at cursor
- I - at beginning of line
- A - “append” at end of line
- o - insert line below (lowercase) current line
- O - insert line above (uppercase) current line
- ESC - exit insert mode

- d - “delete” is same as “cut”

# Ctrl-X

- **d** - “delete” is same as “cut”
- **dd** - delete/cut current line

- `d` - “delete” is same as “cut”
- `dd` - delete/cut current line
- `3dw` - delete/cut three “words”



- y - “yank” is the same as “copy”

- y - “yank” is the same as “copy”
- yy - yank/copy current line

- y - “yank” is the same as “copy”
- yy - yank/copy current line
- 3yw - yank/copy three “words”

- **p** - paste contents of buffer at cursor

- **p** - paste contents of buffer at cursor
- **P** - paste contents of buffer above (uppercase) current line

- **p** - paste contents of buffer at cursor
- **P** - paste contents of buffer above (uppercase) current line
- **u** - remember “undo” when you need it!

## “X” marks the spot

You can constrain the lines you want to affect by a command by “marking” a “range”:

- 1 Mark line with `m` command followed by a character

## “X” marks the spot

You can constrain the lines you want to affect by a command by “marking” a “range”:

- ① Mark line with `m` command followed by a character
- ② Mark another line with `m` command, but ***with a different label character***



## “X” marks the spot

You can constrain the lines you want to affect by a command by “marking” a “range”:

- ① Mark line with `m` command followed by a character
- ② Mark another line with `m` command, but ***with a different label character***
- ③ Use the `'` character to reference a label

## “X” marks the spot

You can constrain the lines you want to affect by a command by “marking” a “range”:

- ➊ Mark line with `m` command followed by a character
- ➋ Mark another line with `m` command, but ***with a different label character***
- ➌ Use the `'` character to reference a label
- ➍ `: 'm, 'ns/This/That/`

# Invoking external commands

- `:1,$!sort`

# Invoking external commands

- `:1,$!sort`
- `: 'm, 'n!sort`

# Step 7

# The Whole Wide World

# Network commands

- `ping yahoo.com` - works like `ping -t` in CMD.EXE

# Network commands

- `ping yahoo.com` - works like `ping -t` in CMD.EXE
- `traceroute yahoo.com`



# Network commands

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- `traceroute yahoo.com`
- `dig yahoo.com`

# Network commands

- `ping yahoo.com` - works like `ping -t` in CMD.EXE
- `traceroute yahoo.com`
- `dig yahoo.com`
- `whois yahoo.com`

# sudo make me a sandwich

- Many commands require “super-user” privileges

# sudo make me a sandwich

- Many commands require “super-user” privileges
- One way to get it is to log-in as “root”

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  - Not recommended in general

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- `sudo` - allows a pre-authorized user to run privileged commands

# sudo make me a sandwich

- Many commands require “super-user” privileges
- One way to get it is to log-in as “root”
  - Not recommended in general
- `sudo` - allows a pre-authorized user to run privileged commands
- `sudo apt-get update`

# Surfin' the command prompt

- `lynx` - command-line browser



# Surfin' the command prompt

- **lynx** - command-line browser
- **wget** - get files over HTTP, FTP, etc.

# Surfin' the command prompt

- `lynx` - command-line browser
- `wget` - get files over HTTP, FTP, etc.
- `curl` - alternative to `wget`

## Sending mail

```
~ $ email --blank-mail --subject "Possibly corrupted files found..." \  
--smtp-server smtp --attach badfiles.csv --from-name NoReply \  
--from-addr noreply@mycorp.com alert@mycorp.com
```

# Logging in elsewhere

- **ssh - secure shell**

# Logging in elsewhere

- ssh - secure shell
  - ssh myuser@remoteserver

# Logging in elsewhere

- `ssh` - secure shell
  - `ssh myuser@remoteserver`
- `scp` - secure copy (over ssh)

# Logging in elsewhere

- `ssh - secure shell`
  - `ssh myuser@remoteserver`
- `scp - secure copy (over ssh)`
  - `scp -r myfiles/* myuser@remoteserver:/home/myuser/myfiles/.`

# Network configuration

- `ifconfig` - display current network settings



# Network configuration

- `ifconfig` - display current network settings
- `cat /etc/resolv.conf` - display current DNS settings

# Network configuration

- `ifconfig` - display current network settings
- `cat /etc/resolv.conf` - display current DNS settings
- `cat /etc/hosts` - display local network aliases

# Step 8

# The Man Behind the Curtain

# View running processes

- **ps** - shows running processes

# View running processes

- `ps` - shows running processes
  - `ps -A` - shows ***all*** running processes

# View running processes

- `ps` - shows running processes
  - `ps -A` - shows ***all*** running processes
  - `ps -A | grep bash` - show all running bash processes

# View running processes

- `ps` - shows running processes
  - `ps -A` - shows ***all*** running processes
  - `ps -A | grep bash` - show all running bash processes
- `top` - show “top” processes by CPU, memory and other criteria



## /proc file system

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```
~ # cat /proc/cpuinfo
```

```
processor      : 0
vendor_id     : GenuineIntel
cpu family    : 6
model         : 37
model name    : Intel(R) Xeon(R) CPU           X5690  @ 3.47GHz
stepping      : 1
microcode     : 0x15
cpu MHz       : 3458.000
cache size    : 12288 KB
fpu           : yes
fpu_exception : yes
cpuid level   : 11
...and so on...
```

- Many live system metrics, presented as “files”

# Sawing logs

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```
~ # ls /var/log
alternatives.log      auth.log.2.gz      debug              dmesg.4.gz        kern....
alternatives.log.1    auth.log.3.gz      debug.1            dpkg.log           kern....
alternatives.log.2.gz auth.log.4.gz      debug.2.gz        dpkg.log.1         kern....
alternatives.log.3.gz btmp               debug.3.gz        dpkg.log.2.gz      kern....
apache2               btmp.1            debug.4.gz        dpkg.log.3.gz      kern....
apt                  daemon.log         dmesg             dpkg.log.4.gz      lastlog
aptitude             daemon.log.1       dmesg.0           exim4              lpr.log
aptitude.1.gz        daemon.log.2.gz    dmesg.1.gz        faillog            mail.err
auth.log              daemon.log.3.gz    dmesg.2.gz        fsck               mail....
auth.log.1           daemon.log.4.gz    dmesg.3.gz        installer          mail....
```

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# It's all temporary

- /tmp - standard location for temp files

# It's all temporary

- /tmp - standard location for temp files
- Cleared at reboot

# Step 9

# How Do You Know What You Don't Know, man?

# man pages

- `man` - “manual” command

# man pages

- `man` - “manual” command
  - `man ls` - help on `ls`



## man pages

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  - `man ls` - help on `ls`
- vi style navigation and searching work

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- Divided into “sections”

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## man pages

- `man` - “manual” command
  - `man ls` - help on `ls`
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- Divided into “sections”
  - Section 1 - user commands (default)
  - Section 5 - system files
  - Section 8 - system commands

## man pages

- `man` - “manual” command
  - `man ls` - help on `ls`
- vi style navigation and searching work
- Divided into “sections”
  - Section 1 - user commands (default)
  - Section 5 - system files
  - Section 8 - system commands
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- `apropos` - search man page titles for a string

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- [Stackoverflow](#)
- Docs for individual packages at maintainer's site (Samba, etc.)

# Step 10



And So On...

```
~ # ls -l /etc
```

```
total 844
```

```
drwxr-xr-x 3 root root 4096 Feb 25 2015 acpi
-rw-r--r-- 1 root root 2981 Apr 23 2014 adduser.conf
-rw-r--r-- 1 root root 45 Jul 9 08:46 adjtime
-rw-r--r-- 2 root root 621 May 22 2014 aliases
-rw-r--r-- 1 root root 12288 May 22 2014 aliases.db
drwxr-xr-x 2 root root 20480 Feb 25 2015 alternatives
-rw-r--r-- 1 root root 4185 Dec 28 2011 analog.cfg
drwxr-xr-x 7 root root 4096 Feb 25 2015 apache2
drwxr-xr-x 6 root root 4096 Feb 25 2015 apt
-rw-r----- 1 root daemon 144 Jun 9 2012 at.deny
-rw-r--r-- 1 root root 1895 Dec 29 2012 bash.bashrc
...and so on...
```

Most system configuration information is here

## Some helpful /etc files

- **fstab** - file systems currently mounted
- **group** - security groups
- **hosts** - network aliases
- **init.d** - startup and shutdown scripts for “services.”
- **mtab** - list of current “mounts.”
- **passwd** - “shadow” file containing all the user accounts
- **resolv.conf** - DNS settings.
- **samba** - file sharing settings for CIFS-type shares

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  - `/etc/init.d/samba stop`
  - `/etc/init.d/samba start`
  - `/etc/init.d/samba restart` - the above two commands combined



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  - dpkg and apt-get on Debian flavors
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- Package managers are like “Add/Remove Programs” - can install, update or delete applications
- Package managers are like “Windows Update” - can update and upgrade the OS

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(...and Ubuntu, Mint and others)

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- `apt-get install curl` - install package “curl”
- `apt-get` is an admin command and usually requires `sudo`
- `dpkg -i somesoftware.deb` - install a package file downloaded from the web

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# Which which is which?

- `which curl` - show which `curl` will execute
- `locate curl` - show all files on system with “`curl`” in the path
- `./curl` - regardless of `$PATH`, execute `curl` that is in current directory

# Over and over and over

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- crontab - show cron jobs for current user
- crontab -e - edit cron jobs for current user
  - sudo crontab -e -u otheruser - edit cron jobs for another user

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- `reboot` - reboot the system (typically requires `sudo`)

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- **reboot** - reboot the system (typically requires **sudo**)
- **shutdown -h now** - shut down system now

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- kill - send a signal to a process
  - Most “signals” allow process to cleanup
  - kill -9 - does **NOT** allow process to cleanup, may corrupt data

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- `echo $?` - show “return code” or exit code for last command or program

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Step -1  
Overview

Step 0 Some  
History

Step 1

Comparing  
CMD.EXE and  
bash

Step 2

Step 3

Finding  
Meaning

Step 4

Grokking grep

Step 5

A Series of  
Pipes

Step 6

vi

Step 7

- `echo $?` - show “return code” or exit code for last command or program
- `a && b` - execute a and if it is successful execute b
- `a || b` - execute a and then execute b regardless of a