
System and Network Engineering - Lecture 3

\$ Basic command line and File manipulation



The Bash shell - /bin/bash

- ❑ **Bash** *GNU Bourne-Again SHell*
- ❑ **<Command> <Options> <Arguments>**
 - ❑ `--help`
 - ❑ `man <command>`

```
BASH(1)                                     General Commands Manual                                     BASH(1)

NAME
    bash - GNU Bourne-Again SHell

SYNOPSIS
    bash [options] [command_string | file]

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DESCRIPTION
    Bash is an sh-compatible command language interpreter that executes commands read from the standard input or from a file.  Bash also incorporates useful features from the Korn and C shells (ksh and csh).

    Bash is intended to be a conformant implementation of the Shell and Utilities portion of the IEEE POSIX specification (IEEE Standard 1003.1).  Bash can be configured to be POSIX-conformant by default.
```

Helpers

- ❑ **Tab completion**

- ❑ **Extra completions**

- ❑ Bash-completion
- ❑ Bash-completion-extras

- ❑ **Command history**

- ❑ history
- ❑ !
- ❑ !! (previous cmd)
- ❑ !a (previous cmd starts with a)
- ❑ !5 (command indexed 5 in the history file)
- ❑ Ctrl + R (search)
- ❑ Ctrl + S (freeze output)

- ❑ **Shortcuts**

- ❑ Ctrl + A (go to beginning)
- ❑ Ctrl + E (go to end)
- ❑ Ctrl + Z (stop and put in the bg)
- ❑ Ctrl + C (terminate process)
- ❑ Ctrl + D (terminate gracefully)
- ❑ etc...

Basic commands

- ❑ **ls (ll)**
- ❑ **less**
- ❑ **echo**
- ❑ **cat**
- ❑ **wc**
- ❑ **sort**
- ❑ **uniq**
- ❑ **cut**
- ❑ **grep**
- ❑ **alias**
- ❑ **clear**

- ❑ **head**
- ❑ **tail**
- ❑ **touch**
- ❑ **stat**
- ❑ **mkdir**
- ❑ **mv**
- ❑ **cp**
- ❑ **rm**
- ❑ **cd**
- ❑ **whereis**
- ❑ **pwd**

Compound commands

- ❑ **Command chaining***

- ❑ &&
- ❑ ||

- ❑ **Command grouping**

- ❑ (list)
- ❑ { list; }
- ❑ ((expression))
- ❑ [[expression]]

```
saltanov@linuxPC:~/temp$ grep a sorted.txt
grep: sorted.txt: No such file or directory
saltanov@linuxPC:~/temp$ echo $?
2
saltanov@linuxPC:~/temp$ grep a sorted.txt || grep a sorted
grep: sorted.txt: No such file or directory
goodbay
say
saltanov@linuxPC:~/temp$ echo $?
0
```

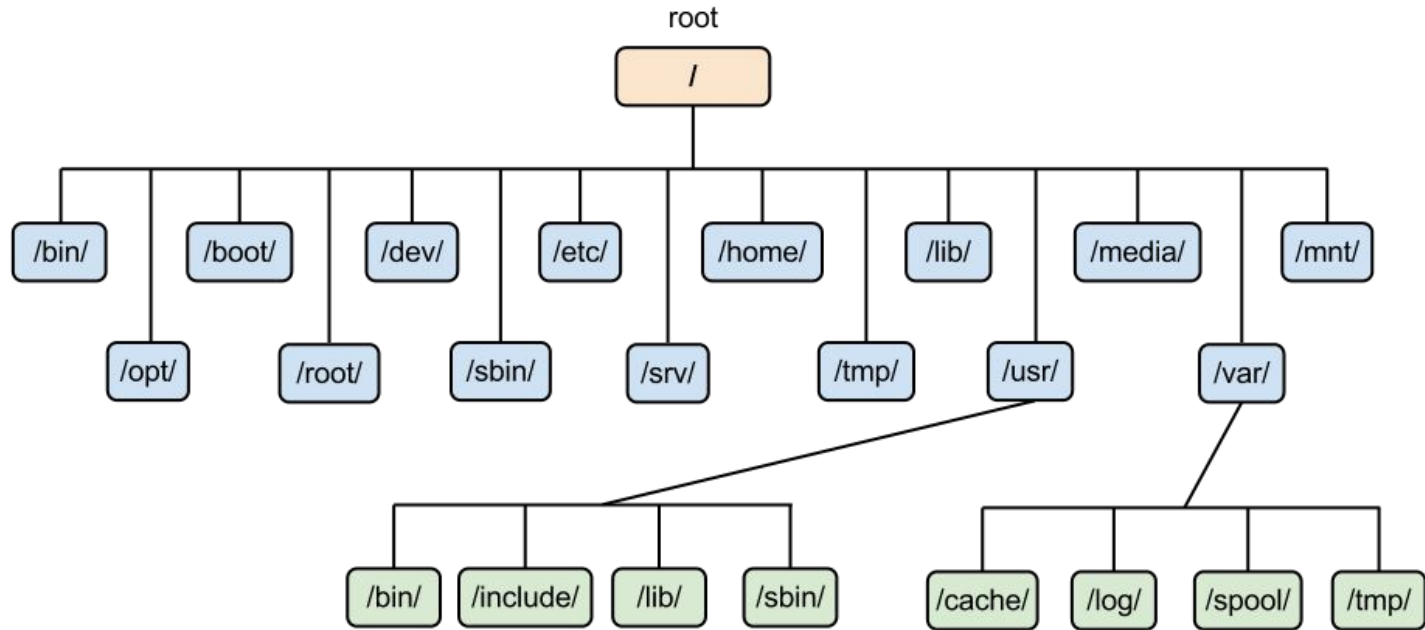
** use \$? to find exit code of a command*

- ❑ If-else
- ❑ For
- ❑ While

```
saltanov@linuxPC:~/temp$ if true; then echo "True!"; else echo "False!"; fi
True!
```

DEMO

The File System hierarchy



Navigation

- ❑ ls
- ❑ cd (cd -)
- ❑ pwd
- ❑ Absolute path
- ❑ Relative path
- ❑ Special symbols:
 - ❑ .
 - ❑ ..
 - ❑ ~ (cd ~)
 - ❑ ~<username>

```
saltanov@linuxPC:~$ cd temp/  
saltanov@linuxPC:~/temp$ cd -  
/home/saltanov  
saltanov@linuxPC:~$ cd /var/  
saltanov@linuxPC:/var$ cd ~  
saltanov@linuxPC:~$ sudo -i  
root@linuxPC:~# pwd  
/root  
root@linuxPC:~# cd ~test  
root@linuxPC:/home/test#
```


Navigation - special meaning of . and ..

- ❑ .. - hardlink to the parent directory (923326)
- ❑ . - hardlink to the current directory (1044612)
- ❑ output `ls -l` shows how many total hardlinks linked to this directory/file
- ❑ there is no hardlinks exist on directories in Linux, except for the current and parent (. and ..)

```
saltanov@linuxPC:~$ ls -ail
total 100
923326 drwxr-x--- 15 saltanov saltanov 4096 Sep 11 17:55 .
652801 drwxr-xr-x  4 root      root      4096 Sep 11 19:32 ..
914460 -rw-r-----  1 saltanov saltanov   700 Sep 11 04:53 .bash_history
927145 -rw-r--r--  1 saltanov saltanov   220 Aug 28 16:17 .bash_logout
923459 -rw-r--r--  1 saltanov saltanov  3771 Aug 28 16:17 .bashrc
936071 drwx----- 12 saltanov saltanov  4096 Sep  4 01:25 .cache
936072 drwx----- 13 saltanov saltanov  4096 Aug 28 19:38 .config
936084 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Desktop
936088 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Documents
936085 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Downloads
915289 -rw-r-----  1 saltanov saltanov    72 Sep 11 17:55 .lesshst
936080 drwx-----  3 saltanov saltanov  4096 Aug 28 17:06 .local
936089 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Music
917077 -rw-r--r--  1 saltanov saltanov   310 Sep  4 01:26 .pam_environment
936090 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Pictures
927144 -rw-r--r--  1 saltanov saltanov    807 Aug 28 16:17 .profile
936087 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Public
1181783 drwx-----  3 saltanov saltanov  4096 Aug 28 17:06 snap
916852 -rw-r--r--  1 saltanov saltanov     0 Aug 29 02:26 .sudo_as_admin_s
1044612 drwxrwxr-x  2 saltanov saltanov  4096 Sep 11 15:32 temp
936086 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Templates
916728 -rw-r-----  1 saltanov saltanov     5 Sep 10 23:59 .vboxclient-clip
916831 -rw-r-----  1 saltanov saltanov     5 Sep 10 23:59 .vboxclient-disp
917081 -rw-r-----  1 saltanov saltanov     5 Sep 10 23:59 .vboxclient-drag
917080 -rw-r-----  1 saltanov saltanov     5 Sep 10 23:59 .vboxclient-search
1178680 drwxr-xr-x  2 saltanov saltanov  4096 Aug 28 17:06 Videos
saltanov@linuxPC:~$ cd temp/
saltanov@linuxPC:~/temp$ ls -ail
total 16
1044612 drwxrwxr-x  2 saltanov saltanov  4096 Sep 11 15:32 .
923326 drwxr-x--- 15 saltanov saltanov  4096 Sep 11 17:55 ..
1045930 -rw-rw-r--  1 saltanov saltanov    58 Sep 11 15:18 sorted
1045933 -rw-rw-r--  1 saltanov saltanov    57 Sep 11 15:40 sorted_numbered
```

Path name expansion

Pattern matching	<code>*, ?</code> (any symbol, any one symbol)
Tilde Expansion	<code>~, ~username, ~+</code> (current path dir), <code>~-</code> (previous path dir)
Square brackets	<code>[abc...]</code> , <code>[!abc...]</code> or <code>[^abc...]</code> ; <code>[:alpha:]</code> , <code>[:lower:]</code> , <code>[:space:]</code> , etc.
Curvy brackets	<code>{1..5}</code> , <code>{1..5..2}</code> , <code>{a, c}</code> , <code>{,d}</code>
Command substitution	<code>\$(..)</code>
Escaping	<code>'..'</code> or <code>\</code>

Command-line file management

❑ cp

- ❑ file1 file2 (make copy of the file)
- ❑ file1 file2 dir (copy several files into dir)
- ❑ -r (copy dir into dir)

❑ mv (move from one location to another)

- ❑ can rename file

```
drwxrwxr-x 3 saltanov saltanov 4096 Sep 11 21:33 ./
drwxr-x--- 15 saltanov saltanov 4096 Sep 11 21:16 ../
drwxrwxr-x 2 saltanov saltanov 4096 Sep 11 19:58 123/
-rw-rw-r-- 1 saltanov saltanov  0 Sep 11 21:33 file
-rw-rw-r-- 1 saltanov saltanov  0 Sep 11 21:33 filed
-rw-rw-r-- 2 saltanov saltanov 58 Sep 11 15:18 sorted
-rw-rw-r-- 2 saltanov saltanov 58 Sep 11 15:18 sorted_hardlink
-rw-rw-r-- 1 saltanov saltanov 57 Sep 11 15:40 sorted_numbered
saltanov@linuxPC:~/temp$ cp file filed 123
saltanov@linuxPC:~/temp$ tree 123
123
├─ file
└─ filed
```

❑ rm

- ❑ -r (remove all recursively)
- ❑ -f (ignore nonexistent files and arguments, never prompt)

❑ mkdir

❑ mkdir -p (create all included dirs)

❑ rmdir (remove only empty directory)

```
saltanov@linuxPC:~/temp$ mkdir -p 123/1/1
saltanov@linuxPC:~/temp$ rm -rf 123/2
saltanov@linuxPC:~/temp$
```

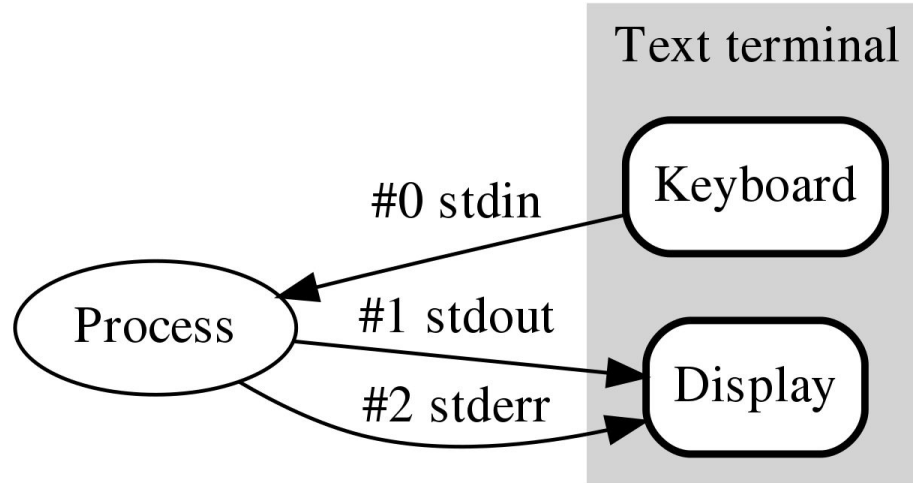
Getting help in Linux; man pages

- ❑ man
- ❑ man man
- ❑ man crontab vs man 5 crontab
- ❑ help or --help
- ❑ man cd vs. help cd
- ❑ info (large linux GNU manual)
- ❑ Sections for man
 - ❑ 1 – User Commands
 - ❑ 2 – System Calls
 - ❑ 3 – C Library functions
 - ❑ 4 – Special files
 - ❑ etc.
- ❑ Find all related man -> search by keyword with -k
 - ❑ man -k exec
- ❑ mans are just archives file under /usr/share/{man,doc}

Numbered channels (data streams); redirection

- ❑ 0 – stdin
- ❑ 1 – stdout
- ❑ 2 – stderr

- ❑ >
- ❑ >>
- ❑ 2>>
- ❑ 2>&1
- ❑ 2>/dev/null



Pipelines

- ❑ |
- ❑ |& (pipe stderr not stdout)
- ❑ tee (write to stdout or a file)

```
saltanov@linuxPC:~/temp$ wc -l sorted | tee file1.txt
8 sorted
saltanov@linuxPC:~/temp$ cat file1.txt
8 sorted
```

Examples:

- ❑ echo "Hello world" | wc -c
- ❑ <command> | grep <something>

```
drwxrwxr-x 3 saltanov saltanov 4096 Sep 12 00:31 .
drwxr-x--- 15 saltanov saltanov 4096 Sep 12 00:41 ..
drwxrwxr-x 3 saltanov saltanov 4096 Sep 11 22:35 123
-rw-rw-r-- 1 saltanov saltanov 9 Sep 12 00:31 file1.txt
-rw-rw-r-- 1 saltanov saltanov 0 Sep 11 21:33 filed
-rw-rw-r-- 2 saltanov saltanov 58 Sep 11 15:18 sorted
-rw-rw-r-- 2 saltanov saltanov 58 Sep 11 15:18 sorted_hardlink
-rw-rw-r-- 1 saltanov saltanov 66 Sep 12 00:29 sorted_numbered
saltanov@linuxPC:~/temp$ cat file1.txt | wc -c
9
saltanov@linuxPC:~/temp$ cat file1.txt
8 sorted
```

Vim

April 1st, 06

vi / vim graphical cheat sheet

Esc
normal
mode

~ toggle case	! external filter	@ play macro	# prev ident	\$ eol	% goto match	^ "soft" bol	& repeat :s	* next ident	(begin sentence) end sentence	_ "soft" bol down	+ next line
\ goto mark	1	2	3	4	5	6	7	8	9	0 "hard" bol	- prev line	= auto ³ format
Q ex mode	W next WORD	E end WORD	R replace mode	T back 'till	Y yank line	U undo line	I insert at bol	O open above	P paste before	{ begin parag.	} end parag.	
q record macro	w next word	e end word	r replace char	t 'till	y yank ^{1,3}	u undo	i insert mode	o open below	p paste after ¹	[misc] misc	
A append at eol	S subst line	D delete to eol	F "back" find ch	G eof/ goto ln	H screen top	J join lines	K help	L screen bottom	. ex cmd line	" reg. ¹ spec	bol/ goto col	
a append	s subst char	d delete ^{1,3}	f find char	g extra ⁶ cmds	h ←	j ↓	k ↑	l →	; repeat t/T/f/F	' goto mk. bol	\ not used!	
Z quit ⁴	X back-space	C change to eol	V visual lines	B prev WORD	N prev (find)	M screen mid'l	< un- ³ indent	> indent ³	? find (rev.)			
Z extra ⁵ cmds	X delete char	c change ^{1,3}	v visual mode	b prev word	n next (find)	m set mark	, reverse t/T/f/F	. repeat cmd	/ find			

Vim

Vim Cheat Sheet

Cursor movement

- h** - move cursor left
- j** - move cursor down
- k** - move cursor up
- l** - move cursor right
- w** - jump forwards to the start of a word
- W** - jump forwards to the start of a word (words can contain punctuation)
- e** - jump forwards to the end of a word
- E** - jump forwards to the end of a word (words can contain punctuation)
- b** - jump backwards to the start of a word
- B** - jump backwards to the start of a word (words can contain punctuation)
- 0** - jump to the start of the line
- ^** - jump to the first non-blank character of the line

Editing

- r** - replace a single character
- J** - join line below to the current one
- cc** - change (replace) entire line
- cw** - change (replace) to the end of the word
- c\$** - change (replace) to the end of the line
- s** - delete character and substitute text
- S** - delete line and substitute text (same as cc)
- xp** - transpose two letters (delete and paste)
- u** - undo
- Ctrl + r** - redo
- .** - repeat last command

Marking text (visual mode)

- v** - start visual mode, mark lines, then do a command (like y-yank)

Cut and paste

- yy** - yank (copy) a line
- 2yy** - yank (copy) 2 lines
- yw** - yank (copy) word
- y\$** - yank (copy) to end of line
- p** - put (paste) the clipboard after cursor
- P** - put (paste) before cursor
- dd** - delete (cut) a line
- 2dd** - delete (cut) 2 lines
- dw** - delete (cut) word
- D** - delete (cut) to the end of the line
- d\$** - delete (cut) to the end of the line
- x** - delete (cut) character

Exiting

- :w** - write (save) the file. but don't exit

DEMO