


LPIC-1 101-400 – Lesson 1

103.1 Work on the Command Line (CLI)



Terminology


- There are many different terms related to the CLI:
 - **Shell:** the command line interface that runs in a terminal to execute commands.
 - **Terminal:** Programs that emulate the behavior of an old school Unix terminal (e.g. VT100)
 - **Console:** Synonym to Terminal
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Examples of Shells

- **bash**: the most popular shell in Linux, default for most systems.
- **bsh**: a simple shell upon which bash was based on
- **dash**: combines the speed of bsh with the functionality of bash
- **csh/tcsh**: inspired from C. Fundamentally different from bash
- **ksh**: merges elements of bsh and csh
- **zsh**: a feature-rich and powerful shell



Examples of Terminals

- GNOME Terminal
 - Konsole (KDE)
 - xterm
 - Terminator
 - TTYs (Ctrl-Alt-F2 ... F6)
 - MobaXterm (Windows)
 - PuTTY (Windows)
 - TeraTerm (Windows)
 - Windows Subsystem for Linux - WSL (Windows)
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The Shell Prompt

- `user@hostname: src$`

The "\$" sign implies non privileged user

- `root@hostname:~#`

The "#" sign implies privileged user (root)

- `echo $PS1`

The \$PS1 variable (Prompt String 1) defines the shell form:

```
[\u@\h \w]\$
```

explanation: \u: username, \h:hostname \w:basename

- Additional information:

```
$ man bash # Lookup PROMPTING
```



Basic Command Syntax

- `<command> <command options> <arguments>`

e.g.:

```
$ ls -la src
```

```
total 24
```

```
drwxrwsr-x  6 root src  4096 2011-06-21 11:34 .
```

```
drwxr-xr-x 11 root root  4096 2011-05-29 14:34 .
```

```
drwxr-xr-x  4 root root  4096 2011-05-29 14:34 fglrx-  
8.840
```

```
drwxr-xr-x 24 root root  4096 2011-05-29 14:30 linux-  
headers-2.6.38-8
```

```
drwxr-xr-x  7 root root  4096 2011-05-29 14:30 linux-  
headers-2.6.38-8-generic
```

```
drwxr-xr-x 11 root root  4096 2011-06-21 11:34  
virtualbox-ose-4.0.4
```

Builtins and external commands


- Builtin commands are commands provided by the shell itself, e.g. `export`, `alias`, `cd` etc
- more info: `man builtins`
- External commands are distinct executable files, e.g. `ls`, `man`, `which`

more info: `man <command>`
- There are commands that are both external and builtin, like `echo` and `pwd`

In this case priority goes to builtins



Basic Commands

- **cd**: change directory
 - **pwd**: print working directory
 - **echo**: print text/variables in stdout
 - **export**: export variables
 - **man**: manual pages for commands
 - **uname**: system information
 - **exec**: Execute a file
 - **type**: Show type of command
 - **which**: show path of external command
 - **exit**: exit current session/shell
 - **logout**: exit current session
 - **time**: calculate execution time
 - **history**: show command history
 - **env**: show environment variables
 - **set**: show/set variables
 - **unset**: unset variables
 - **history**: show list of past commands
- 

Absolute – Relative Paths

- Absolute paths always start with “/”, e.g.:

/home/user/bin

- Relative path start from the current direstory, e.g.:

./bin points to **/home/user/bin** if you are in **/home/user** already

- The dot and slash “./” can be omitted, e.g.:

bin points to **/home/user/bin** if you are in **/home/user** already

- A double dot and slash “../” is interpreted as “Go back one directory” e.g.:

../user2/bin points to **/home/user2/bin** if you already in **/home/user**

- The tilde character “~” and the variable **\$HOME** point to the current user’s home directory (homedir), e.g.

if the user name is “**user**” then **~/bin** and **\$HOME/bin** point to **/home/user/bin**

Command Execution

- First priority goes to builtins.
- Next priority goes to every executable file in the **\$PATH**, e.g.:

```
$ echo $PATH  
/home/theo/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin: /sbin:/bin:/usr/games
```

- Directories in the left side are given higher priority than directories in the right, e.g.
/home/theo/bin/ls has priority over **/bin/ls**

- `$ ls -l /bin/bash`

```
-rwxr-xr-x 1 root root 954896 2011-04-01 00:20 /bin/bash  
The x character states that the file /bin/bash is an executable.
```

Command Execution

- For commands not included in the `$PATH` you should explicitly define the absolute or relative path, e.g: `/usr/lib/gettext/hostname` or `./commands/testing`
- The `exec` command can execute other executables
- To execute a command in the current directory we use “`./`” e.g.: `./testing`
- For successive command execution we can use “`;`” e.g.: `<cmd1> ; <cmd2> ; <cmd3>`



Command Substitution

- We can expand the output of a command to be used as an argument to another command.
- There are two ways to do this:
`$(command)` or ``command``.
The former is recommended as it is safer when there are strange meta-characters in the command
- `$ echo $HISTFILE # show the file where the command history is saved`
- `$ ls -l $(echo $HISTFILE) # The echo $HISTFILE command is invoked first and it's output is passed as an argument to the ls -l command.`

Command Completion

- Bash as well as other shells provide a “**command completion**” feature by invoking the “**Tab**” key
- A single **Tab** will auto-complete the following characters, provided they are unique:

```
$ pass<Tab> → $ passwd
```

- Two successive **Tabs** will display other possible commands, if the set already typed is not unique:

```
$ pas<Tab><Tab> →  
passwd          paste
```

```
pasuspender
```



Command Completion

- The same logic applies to paths, e.g.:

```
$ cd /var/lo<Tab><Tab> →  
local/ lock/ log/
```

- \$ cd /var/loca<Tab> →
\$ cd /var/local/


Note: some systems (like Ubuntu) have extended this concept to options/parameters completion or even the file type expected by the command.

Command History

- The **history** command will return a list with the most recent commands
- **\$HISTSIZE**: this variable will display the size of the command history
(default: **1000** commands)
- **\$HISTFILE**: this variable will return the command history file
(default: `~/.bash_history`)



Command History Expansion

- **!!** Executes the most recent command
 - **!**n**** Execute the **nth** command. We can use the **history** command to see the command numbers.
 - **!**-n**** Execute the **nth** from the end of the command history.
 - **!**string**** execute the most recent command starting with the characters “**string**”.
 - **!**?string**** execute the most recent command containing the characters “**string**”.
 - **^**string1**^**string2**** repeat last command, replacing “**string1**” with “**string2**”.
 - **\$ **fc**** edits the most recent command history
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Shell Shortcuts

- **Ctrl-p** Go a command back (also 'Up Arrow')
- **Ctrl-n** Next command (also 'Down Arrow')
- **Ctrl-b** A character backwards (also 'Left Arrow')
- **Ctrl-f** A character forward (also 'Right Arrow')
- **Ctrl-a** Go to the beginning of a line (also 'Home')
- **Ctrl-e** Go to the end of line (also 'End')
- **Ctrl-t** Transpose the character left of the cursor with the character under the cursor
- **Ctrl-l** Clear screen but leave the current line to the top of the screen

Note: The Bash shell has the same shortcuts as the Emacs editor



Shell Shortcuts

- **Meta-<** Go to the top of the command history
- **Meta->** Go to the bottom of the command history
- **Ctrl-d** Delete character right of the cursor
- **Ctrl-k** Delete (kill) the text to the end of line
- **Ctrl-y** Paste (yank) the deleted text
- **Meta-d** Delete (kill) the current word
- **Ctrl-rtext** search text backwards
- **Ctrl-stext** search text forward
- **Ctrl-x Ctrl-e** invoke the default text editor

Note: the 'Meta' key is usually assigned to the 'Alt' key

Environment and Shell Variables

- `$ PROXY=http://proxy.domain.int #`
set a Shell variable
- `$ export PROXY #` export a variable
to child shells
(Environment Variable)
- `$ export`
`PROXY=http://proxy.domain.int #`
combine the previous two commands
in one




The `echo` command

- `$ echo $PROXY # show the value of the PROXY variable`
`http://proxy.domain.int`
- `$ echo "Proxy = $PROXY" # Double quotes expand variable`
`Proxy = http://proxy.domain.int`
- `$ echo 'Proxy = $PROXY' # Single quotes show the exact`
`string`
`Proxy = $PROXY`



Commands `env`, `set` and `unset`

- The `env` command will return the list of environment variables:
`$ env | more # (press q to exit more)`
 - The `set` command will return the list of shell variables:
`$ set | less # (press q to exit less)`
 - `$ unset PROXY # unset the variable $PROXY from the Shell and Environment`
 - `$ set -o # status of shell options`
 - `$ set -o/+o <option> # set/unset shell options`
 - `$ set -o vi # use vi shortcuts instead of emacs in the bash shell`
 - `$ set +o history # disable the command history`
 - `$ set -o allexport # export all variable to the Environment`
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The `uname` command

The `uname` command will return some useful information about our system

- `$ uname -a` # display all available info
- `$ uname -r` # kernel release
- `$ uname -n` # machine hostname
- `$ uname -v` # kernel version and info
- `$ uname -o` # os name
- `$ uname -s` # kernel name
- `$ uname -m` # system architecture



The `which` and `type` commands

- `$ which set # no external command named `set``
- `$ $ type set # set is a builtin command
set is a shell builtin`
- `$ which echo # path of echo external command
/usr/bin/echo`
- `$ type echo # `echo` is builtin AND external
echo is a shell builtin`
- `$ type ls # ls is in fact an alias
ls is aliased to `ls -color=auto``
- `$ \ls # run the unaliased version of `ls``



Getting Help with commands

- Most command support the **-h** or **--help** options (or both) for basic help, e.g.:
- `$ ls --help`
- `$ gzip -h`
- The **man** will give us a more detailed description of the command, e.g.:

```
$ man bash
```

- Some command make use of the **info** command for an even more detailed description. **info** supports hyperlinks. Example:

```
$ info date
```

”When all else fails, read the manual”

~ Ancient UNIX proverb ~



Manpages Sections

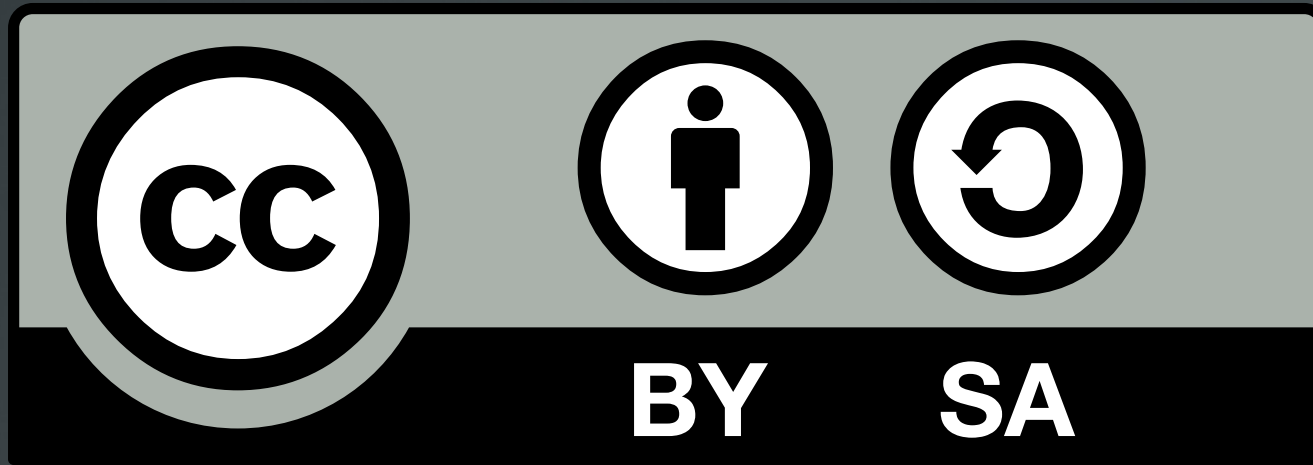
Section ID	Description
1	User Programs and Commands
2	Kernel System Calls
3	Library Calls
4	Devices Files in /dev
5	File Formats
6	Games
7	Various
8	System commands
9	Kernel Routines

Using the `man` command

- `$ man -wa passwd # show all man files related to passwd`
- `$ man passwd # displays the first of the 3 pages based on the priority: 1:8:2:3:4:5:6:7:9`
- `$ man 1 passwd # shows the man page related to passwd in section 1`
- `$ man 1ssl passwd # shows the man page related to passwd in subsection 1ssl`
- `$ man 5 passwd # shows the man page related to passwd in section 5`
- `$ man -a passwd # shows successively all man pages named passwd`
- `$ man -f passwd # (identical to whatis) shows a brief description of all pages named passwd`
- `$ man -k passwd # (identical to apropos) shows a brief description of all pages containing passwd`
- `$ man -K passwd # shows successively all man pages named containing passwd in their content`



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