

The Command Line and More

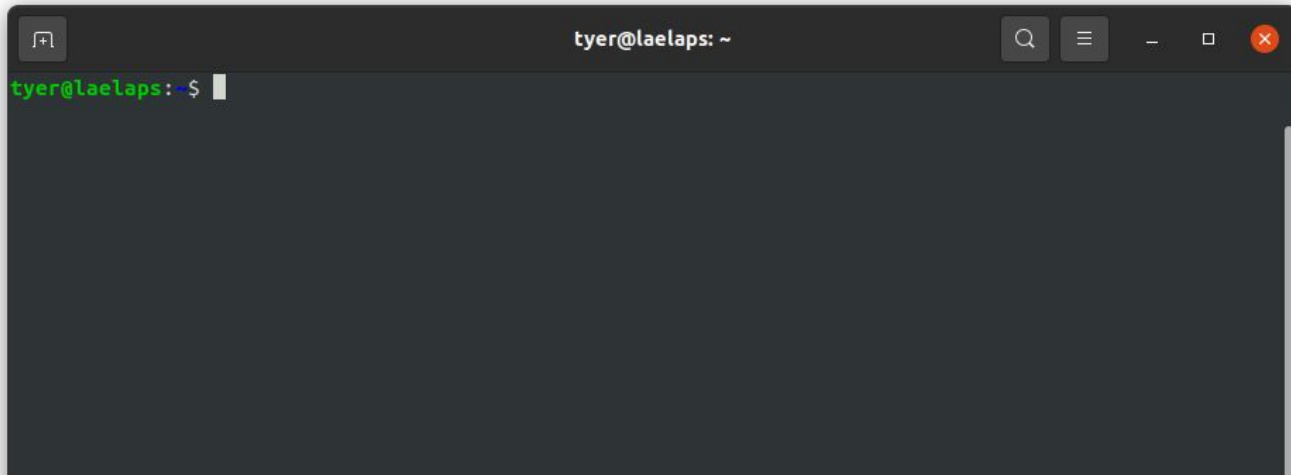
What should I learn?

- The same activities you perform within a file explorer window.
- How to install, check versions, and run software.
- Modify configuration settings.
- Basic troubleshooting.

What is a Command Line Interpreter (CLI)?

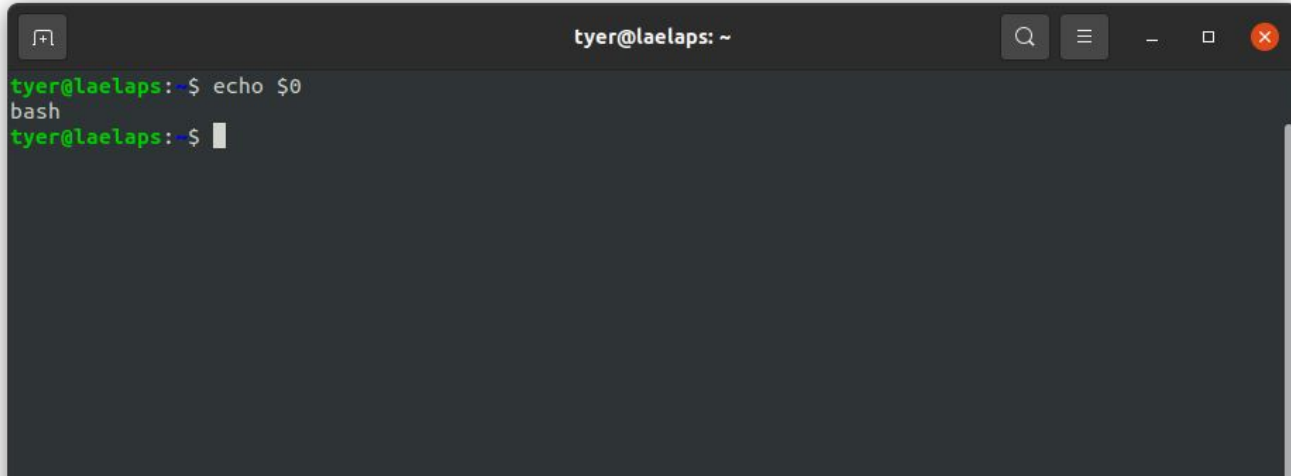
Per wikipedia:

In computing, a command-line interpreter, or command language interpreter, is a blanket term for a certain class of programs designed to read lines of text entered by a user, thus implementing a command-line interface.



What CLI am I using?

- Windows
 - PowerShell
 - CMD
- MacOS
 - Bash
 - zsh
- Linux
 - Bash
 - many more...



A terminal window titled "tyer@laelaps: ~" with standard window controls. The prompt is "tyer@laelaps:~\$". The user enters "echo \$0", which outputs "bash". The user then enters "bash", which changes the prompt to "tyer@laelaps:~\$".

```
tyer@laelaps:~$ echo $0
bash
tyer@laelaps:~$
```

The PATH to programs

Common across major operating systems, there is:

the **PATH** *environment variable*.

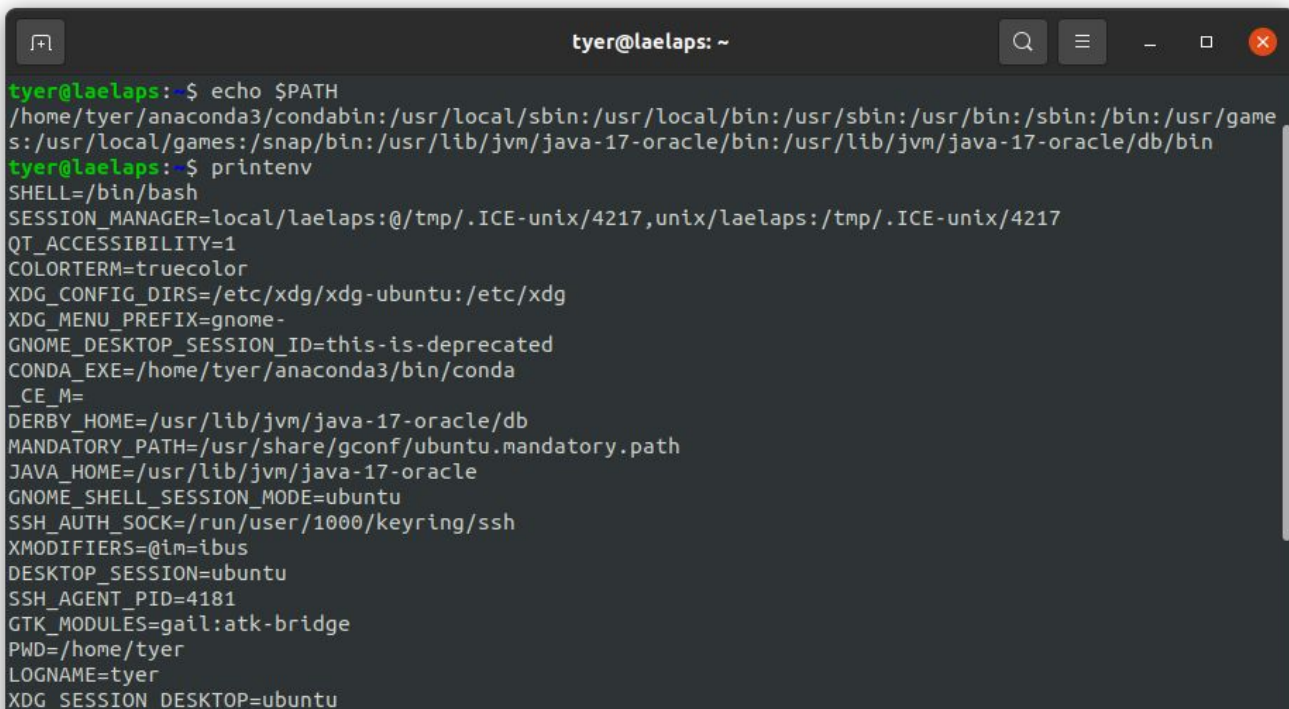
It stores a list of locations where programs are located.

A terminal window titled 'tyer@laelaps: ~' with standard window controls. It shows two commands being executed: 'echo \$0' which returns 'bash', and 'echo \$PATH' which returns a long list of directory paths separated by colons. The paths include system directories like /usr/local/sbin, /usr/local/bin, /usr/sbin, /usr/bin, /sbin, /bin, and /usr/games, as well as user-specific paths like /home/tyer/anaconda3/condabin and /usr/lib/jvm/java-17-oracle/bin.

```
tyer@laelaps:~$ echo $0
bash
tyer@laelaps:~$ echo $PATH
/home/tyer/anaconda3/condabin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/usr/lib/jvm/java-17-oracle/bin:/usr/lib/jvm/java-17-oracle/db/bin
tyer@laelaps:~$
```

Environment Variables

An environment variable is a collection of key: value data, usable by the shell.

A terminal window titled 'tyer@laelaps: ~' with standard window controls (search, menu, zoom, close). The terminal shows the output of 'echo \$PATH' and 'printenv' commands. The \$PATH output is a long string of directory paths. The printenv output lists various system and user environment variables such as SHELL, SESSION_MANAGER, QT_ACCESSIBILITY, and XDG_CONFIG_DIRS.

```
tyer@laelaps:~$ echo $PATH
/home/tyer/anaconda3/condabin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/usr/lib/jvm/java-17-oracle/bin:/usr/lib/jvm/java-17-oracle/db/bin
tyer@laelaps:~$ printenv
SHELL=/bin/bash
SESSION_MANAGER=local/laelaps:@/tmp/.ICE-unix/4217,unix/laelaps:/tmp/.ICE-unix/4217
QT_ACCESSIBILITY=1
COLORTERM=truecolor
XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
XDG_MENU_PREFIX=gnome-
GNOME_DESKTOP_SESSION_ID=this-is-deprecated
CONDA_EXE=/home/tyer/anaconda3/bin/conda
_CE_M=
DERBY_HOME=/usr/lib/jvm/java-17-oracle/db
MANDATORY_PATH=/usr/share/gconf/ubuntu.mandatory.path
JAVA_HOME=/usr/lib/jvm/java-17-oracle
GNOME_SHELL_SESSION_MODE=ubuntu
SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
XMODIFIERS=@im=ibus
DESKTOP_SESSION=ubuntu
SSH_AGENT_PID=4181
GTK_MODULES=gail:atk-bridge
PWD=/home/tyer
LOGNAME=tyer
XDG_SESSION_DESKTOP=ubuntu
```

Windows Registry

An equivalent to the text based configuration used in Linux and MacOS.

RegEdit is a program included to modify registry values.

BASH Syntax

The language we use to interact with the shell is BASH. The Bourne again shell.

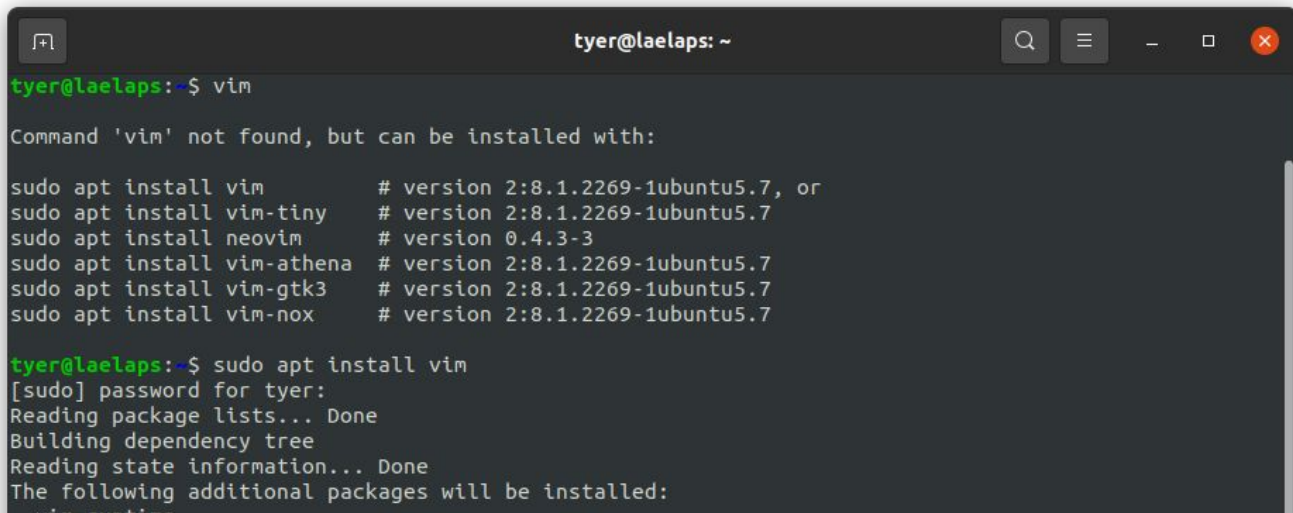
[Bash Cheat sheet](#)

[The Command Line Crash Course](#)

Installing Programs with Package Managers

Most often software is installed using a package manager:

- Linux: apt
- MacOS: brew
- Windows: choco



```
tyer@laelaps: ~  
tyer@laelaps:~$ vim  
Command 'vim' not found, but can be installed with:  
  
sudo apt install vim          # version 2:8.1.2269-1ubuntu5.7, or  
sudo apt install vim-tiny     # version 2:8.1.2269-1ubuntu5.7  
sudo apt install neovim       # version 0.4.3-3  
sudo apt install vim-athena   # version 2:8.1.2269-1ubuntu5.7  
sudo apt install vim-gtk3     # version 2:8.1.2269-1ubuntu5.7  
sudo apt install vim-nox      # version 2:8.1.2269-1ubuntu5.7  
  
tyer@laelaps:~$ sudo apt install vim  
[sudo] password for tyer:  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:
```

Installing from Source: MakeFiles

Per Wikipedia:

Make is a build automation tool that automatically builds executable programs and libraries from source code by reading files called Makefiles which specify how to derive the target program.

Kamiak

If you wish to connect to a particular login node you can ssh to

- `login-p2n01.kamiak.wsu.edu`
- `login-p2n02.kamiak.wsu.edu`.

SLURM

modules

Accounts and Permissions

Number Binary resulting permission

0	000	---
1	001	--x
2	010	-w-
3	011	-wx
4	100	r--
5	101	r-x
6	110	rw-
7	111	rwX

chmod 755 [dirname] rwxr-xr-x

```
shum@sol:~$ ls -l
total 20
drwx----- 2 shum  staff  4096 Jan 16 22:04 Mail
drwx----- 3 shum  staff  4096 Jan 16 14:15 csc128
drwxr-xr-x  2 shum  staff  4096 Jan 13 16:42 public
drwxr-xr-x  2 shum  staff  4096 Jan 16 14:07 public_html
-rw-r--r--  1 shum  staff   628 Jan 15 20:04 verse
```

file type

number of hard links

user (owner) name

group name

size

date/time last modified

filename

other (everyone) permissions

group permissions

user permissions

rwx

executable

writable

readable

File Links

- Hard links
 - `ln [original filename] [link name]`
 - Duplicate inode reference to a location on a drive.
- Soft links
 - Crosses file systems and directories
 - Only the path of the original, not the data.
 - `ln -s [original filename] [link name]`

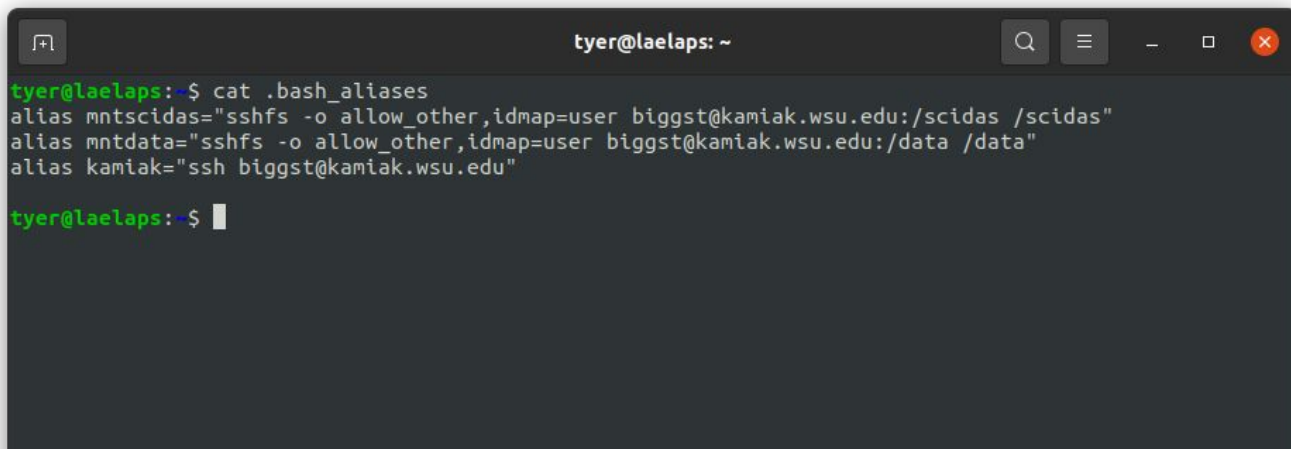
Configuring Bash

.bashrc

.bash_aliases

umask u=rwx,g=rx,o=rx

umask 755

A terminal window titled 'tyer@laelaps: ~' with standard window controls (search, menu, zoom, close). The terminal shows the command 'cat .bash_aliases' and its output, which defines three aliases: 'mntscidas' for mounting the scidas directory via sshfs, 'mntdata' for mounting the data directory via sshfs, and 'kamiak' for ssh-ing to the kamiak machine.

```
tyer@laelaps:~$ cat .bash_aliases
alias mntscidas="sshfs -o allow_other,idmap=user biggst@kamiak.wsu.edu:/scidas /scidas"
alias mntdata="sshfs -o allow_other,idmap=user biggst@kamiak.wsu.edu:/data /data"
alias kamiak="ssh biggst@kamiak.wsu.edu"

tyer@laelaps:~$
```

Kamiak Modules via Lmod

Lmod - LUA based module system.

Lmod is a Lua based module system that easily handles the MODULEPATH Hierarchical problem. Environment Modules provide a convenient way to dynamically change the users' environment through modulefiles. This includes easily adding or removing directories to the PATH environment variable. Modulefiles for Library packages provide environment variables that specify where the library and header files can be found.

SSH, SFTP and More

- SSH - Secure Shell
 - `ssh username@public_ip_address`
- SFTP - SSH File Transfer Protocol
 - `sftp remote_username@server_ip_or_hostname`
- SCP - Secure Copy
 - `scp [OPTION] [user@]SRC_HOST:]file1 [user@]DEST_HOST:]file2`
- rsync
 - Local to Local: `rsync [OPTION]... [SRC]... DEST`
 - Local to Remote: `rsync [OPTION]... [SRC]... [USER@]HOST:DEST`
 - Remote to Local: `rsync [OPTION]... [USER@]HOST:SRC... [DEST]`

More Resources

[SuperUser](#)

[tmux](#)

[One-liners](#)

Go too far:

[emacs](#)

Tour of TMUX and VIM

```
→ ~ Welcome to tmux!

→ ~ ssh mustafar
Last login: Sun Sep 25 23:04:54 2016 from 192.168.20.22
Linux mustafar 4.6.3-1-ARCH unknown
23:00:04 up 90 days, 1:42, 13 users, load average: 0.65, 2.43, 2.01
~
Sun 25 Sep 2016 11:04:34 PM CEST

→ ~ sudo -i
Password:
tatooine:~ root#

Last login: Sun Sep 25 23:00:04 2016 from 192.168.20.22
Linux mustafar 4.6.3-1-ARCH unknown
23:04:34 up 90 days, 1:47, 14 users, load average: 0.89, 1.43, 1.68
~
Sun 25 Sep 2016 11:04:34 PM CEST
```

☐ 0 ↑ 34d 1h 34m 1 bash 2 bash 3 bash ⚡ 100% < 23:00 < 25 Sept root tatooine