

{ POWER.CODERS }

Intro to the Command Line

MORNING

- › Introduction to the internet
- › Quick intro to search engines
- › Command line
- › Why and how use the command line?

AFTERNOON

- › Practical exercises with command line
- › Our project over the next 7 weeks

INTRODUCTION TO THE INTERNET

KEY FACTS



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- › 82% of traffic video streams

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In 2017 one google engineer made a mistake resulting in a loss of internet for Japan for a couple hours

WHAT IS THE INTERNET?

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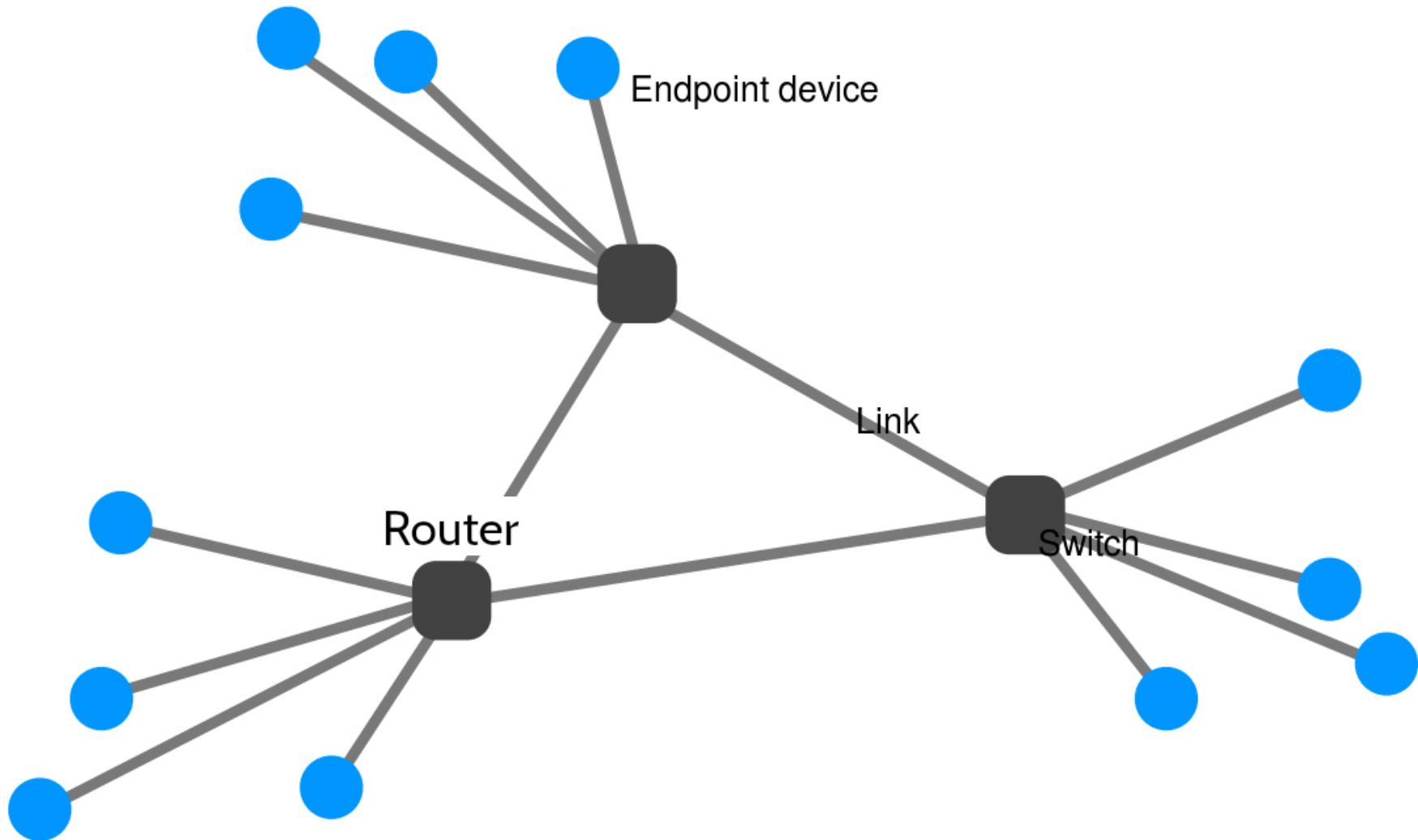
It is a network of networks

WHAT IS THE INTERNET?

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... and it is **HUGE.**

WHAT IS A NETWORK MADE OF?



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submarinecablemap.com

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WHY DO WE CARE HOW THE INTERNET WORKS?

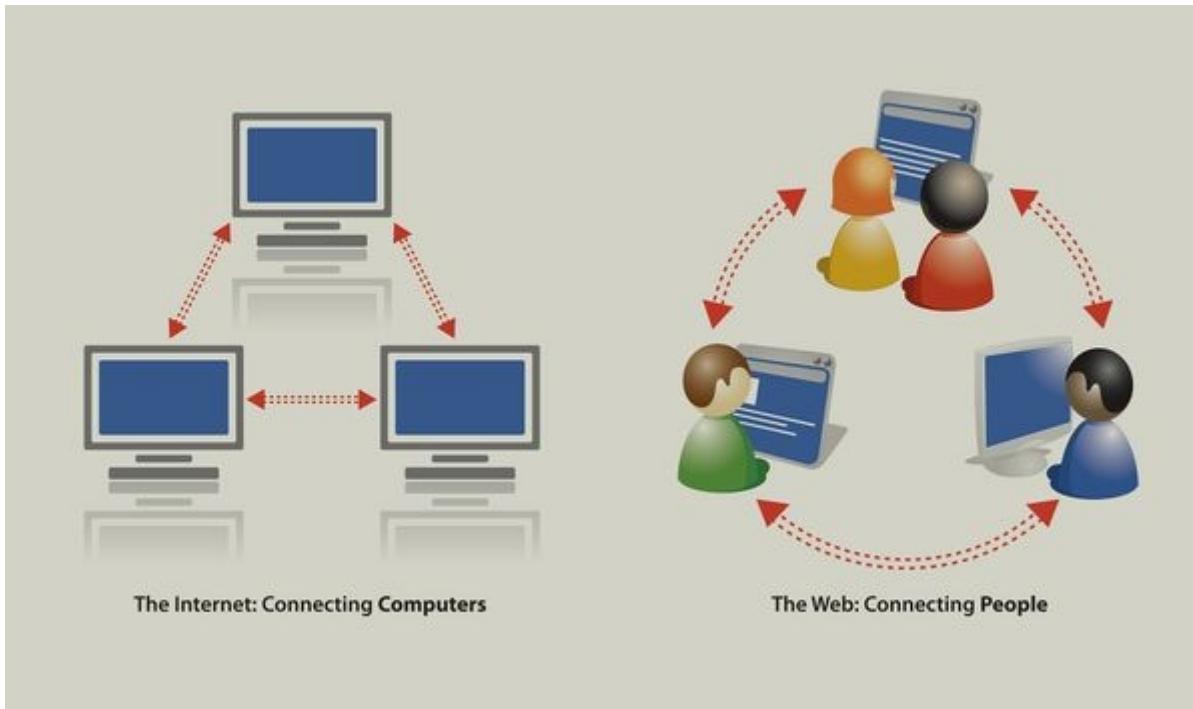
WHY DO WE CARE HOW THE INTERNET WORKS?

When you create websites you should have basic knowledge of the environment you build it for. And you should be aware how important security and performance are.

BROWSING THE WEB

INTERNET VS WEB?

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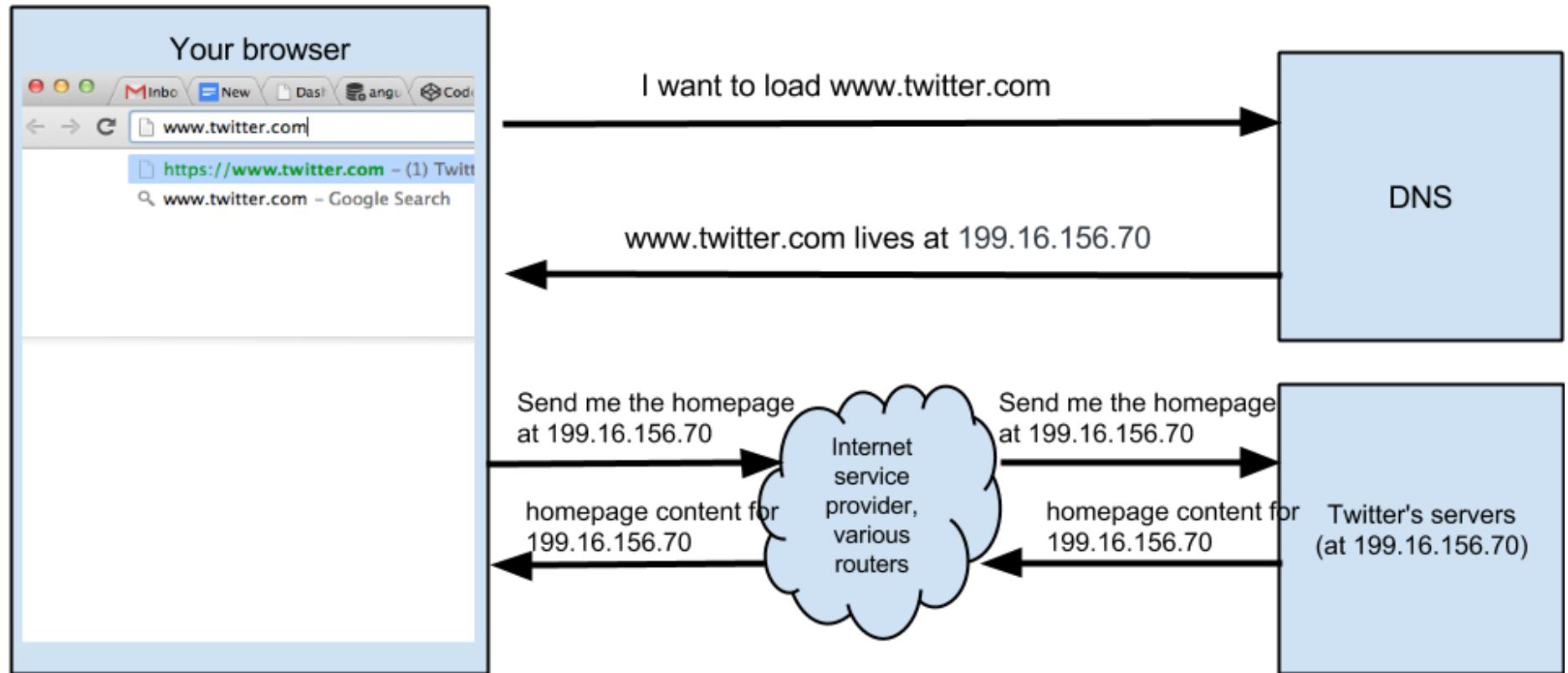
INTERNET VS WEB?

Internet:

Network of networks. Global network of interconnected computers that communicate via **TCP/IP**.

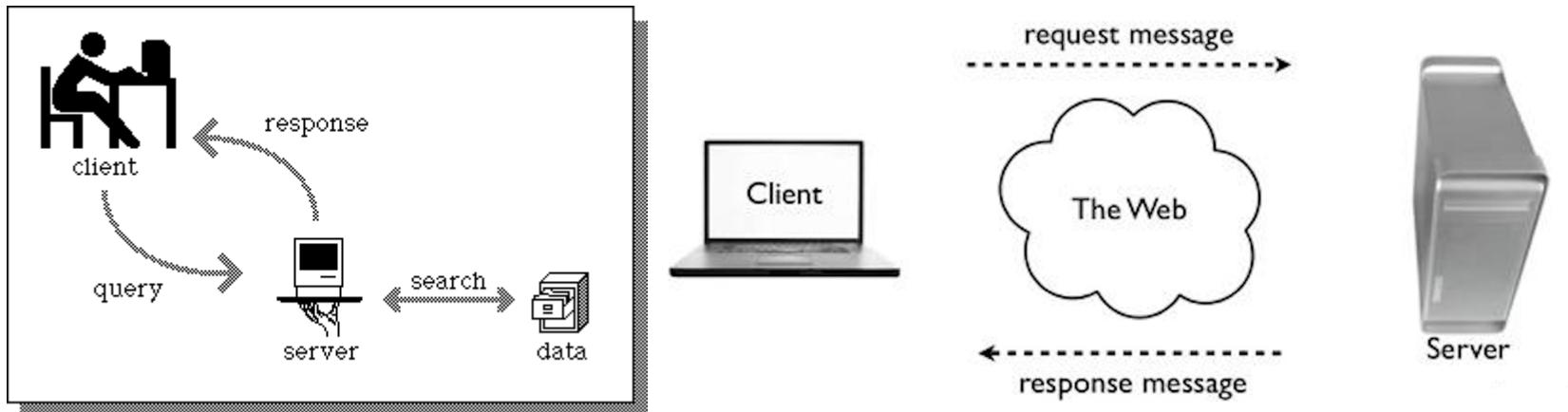
Web:

The world wide web is an information system where documents and other resources are available over the internet. Documents are transferred via **HTTP/S**.



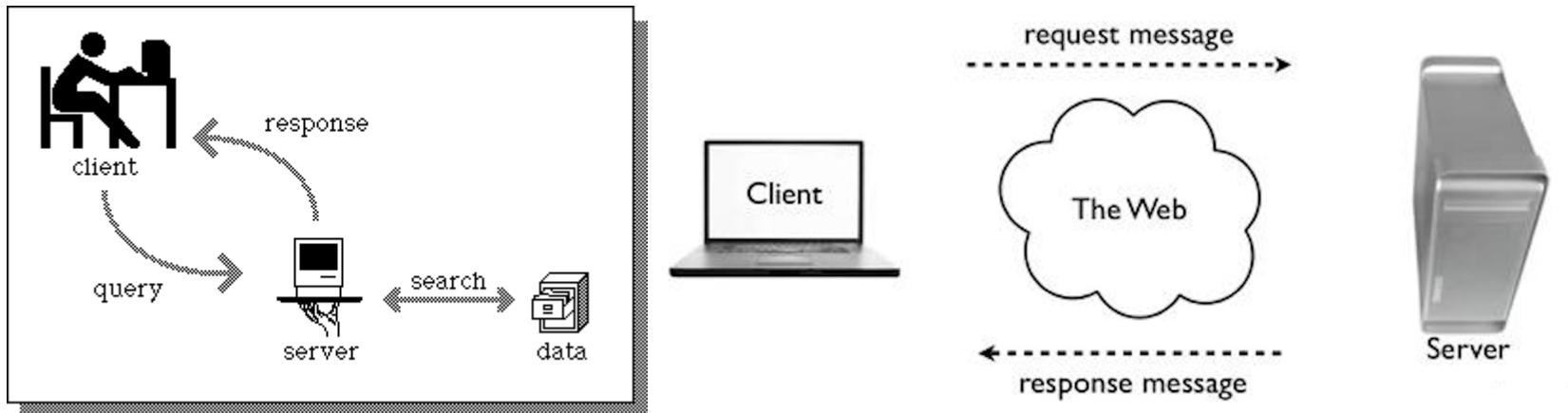
CLIENTS AND SERVERS

How your computer accesses websites



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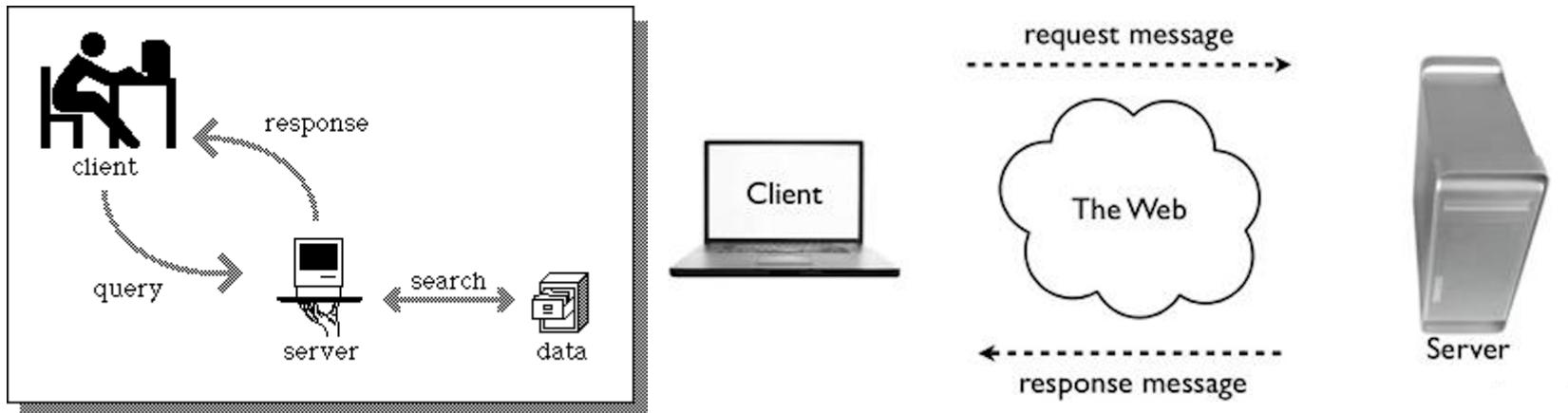
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- › Computers can be **CLIENTS** or **SERVERS**

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results in an URL: `https://powercoders.org/volunteer/it-trainer/`

URL PROTOCOL

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- › **tel: phone protocol**

Triggers an external phone client and creates a new call via voice over IP

DOMAIN

Anatomy of domain names:

subdomain.domain.topleveldomain

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- › powercoders.org
- › www.gmail.com
- › calendar.google.com

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```
nslookup powercoders.org
```

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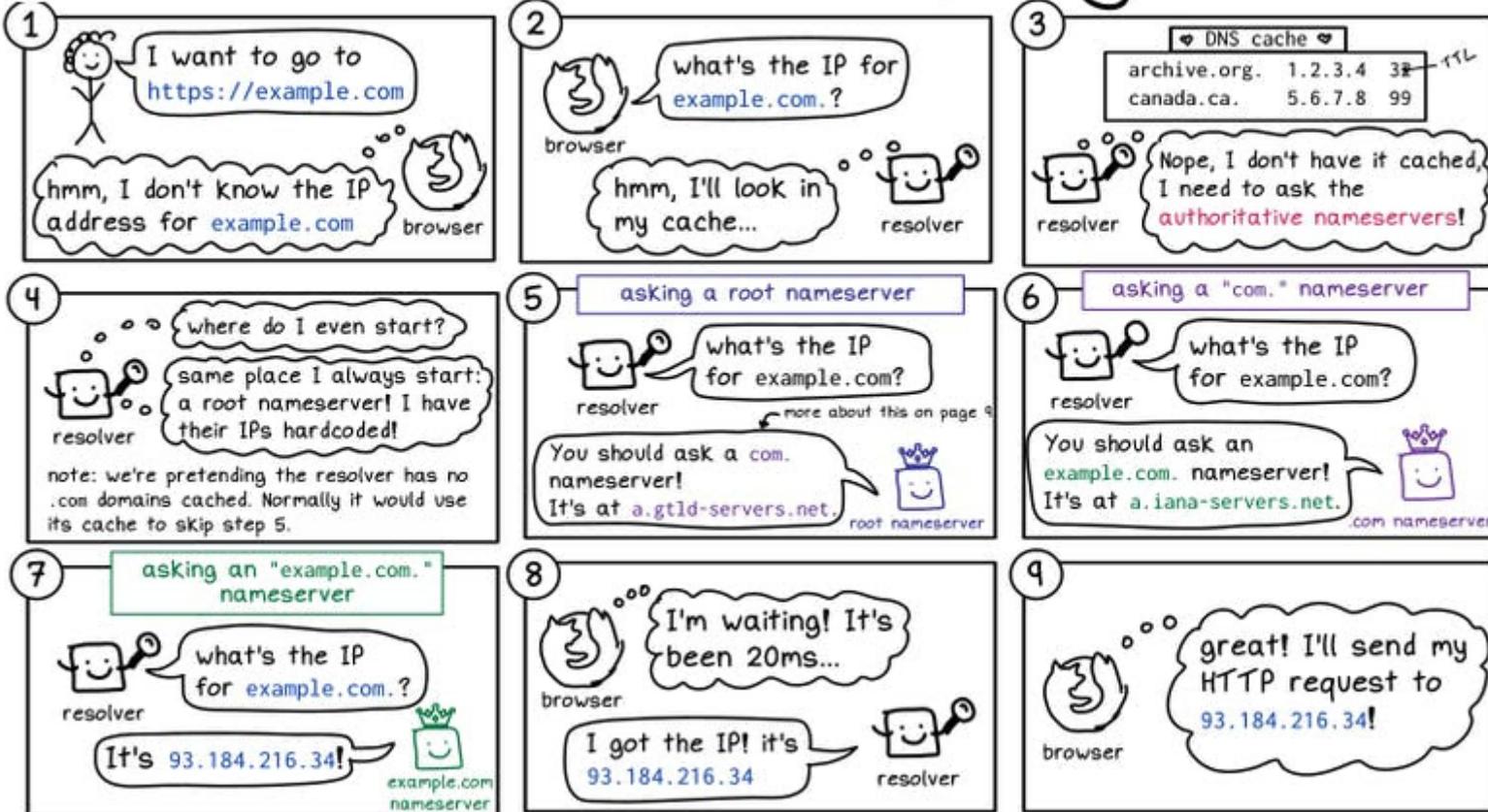
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Web servers are often large computers connected to a network.

1. Type a web address (=URL) into the address bar
2. DNS connects you to the hosting server
3. Files are then sent back to your computer for display

JULIA EVANS
@b0rk

life of a DNS query



INTRO TO SEARCH ENGINES: How to Google

”Search engines exist to **discover, understand, and organize** the internet's content in order to offer the **most relevant results to the questions** searchers are asking.

How do search engines work?

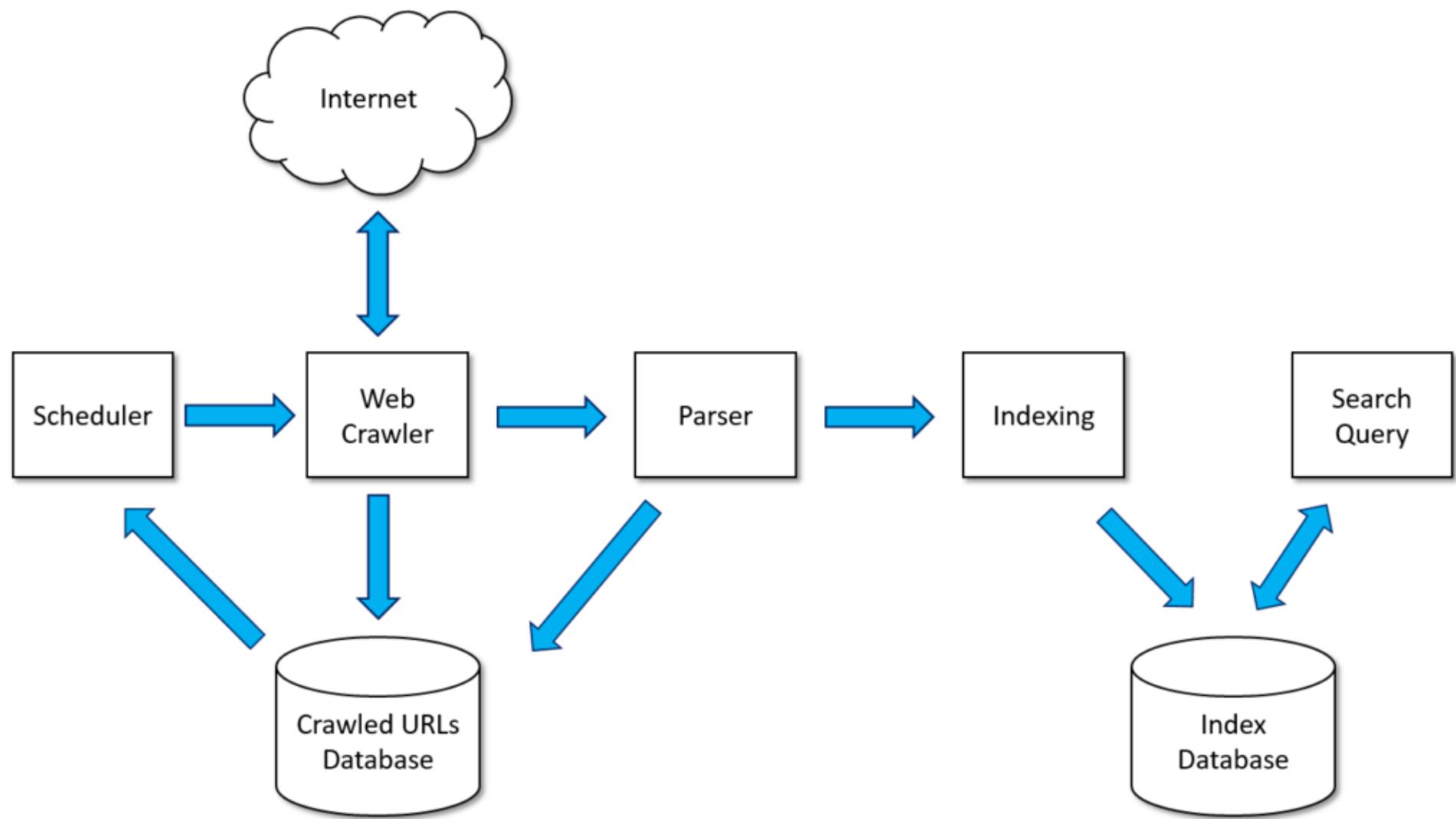
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- › **Ranking**: then the results of a search engine are ordered by relevance to answer the searcher's query.



How TO SEARCH

- › Search in English more results
- › Use more than one word e.g. how to learn programming
- › Give context e.g. go programming language
- › Be precise e.g. go programming language for absolute beginners
- › Use operators e.g. "math operators" javascript -jquery
- › Check dates and up-to-dateness
- › Use more than one source
- › Search also images, scholar or books

EXERCISE 1

You want to find a co-working space nearby. You need to do some research online first.

EXERCISE 2

You want to learn Python and you are looking for the course / book / tutorial that fits your needs best.

COMMAND LINE

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- › The shell is just another program

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 - › Terminal
 - › Command prompt
 - › Console
 - › CLI

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- › In the 1960s CLI was the standard user interface
- › CLI was the only way to communicate with the computer
- › Wrong commands in the CLI often resulted in deleted data
(= bad user experience)



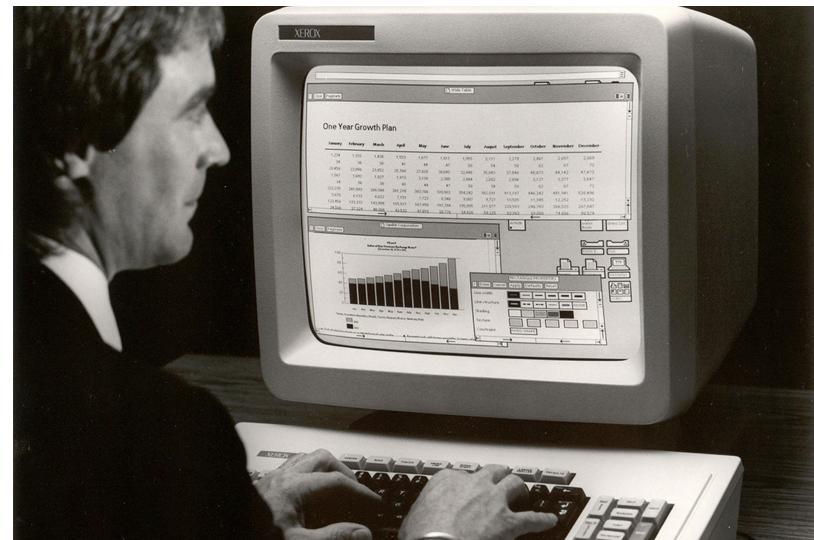
?





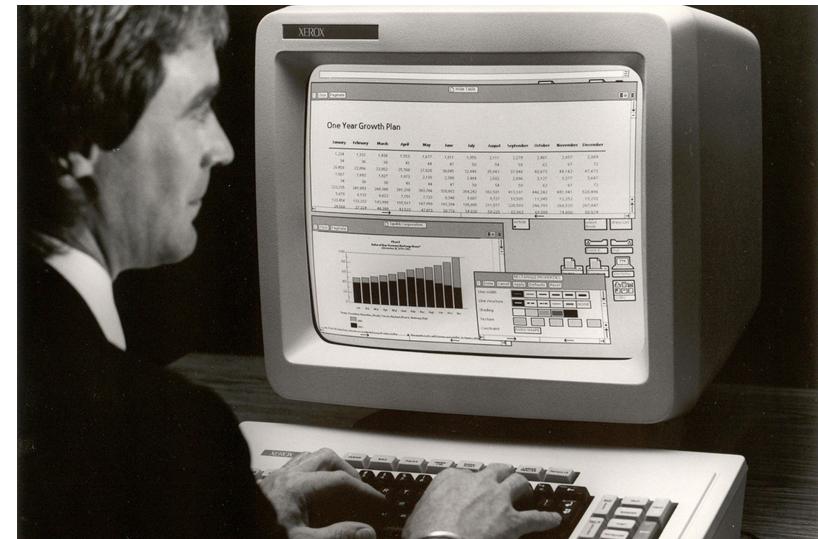
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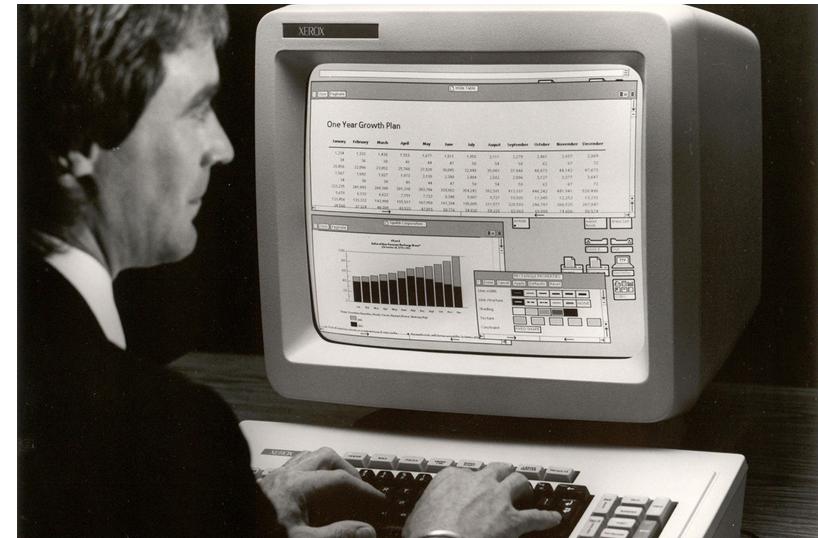
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GUI (GRAPHICAL USER INTERFACE)

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- › The interaction with the computer moved to point-and-click, a lot saver for the average user
- › Operating systems started to offer a **Graphical user interface**



AND SO WHEN WILL I USE CLI?

In general you might use the command line to...

- › Work with files and directories

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- › Manage computer processes
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- › Handle networking (remember `nslookup`)
- › Use version control (like Git)

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- › **Bash** (**Born again shell**) is the popular default shell on Linux and macOS.
- › Windows uses **PowerShell** and **cmd.exe**, 2 different shells with their own syntax.
- › We already installed **zsh** as our preferred shell.

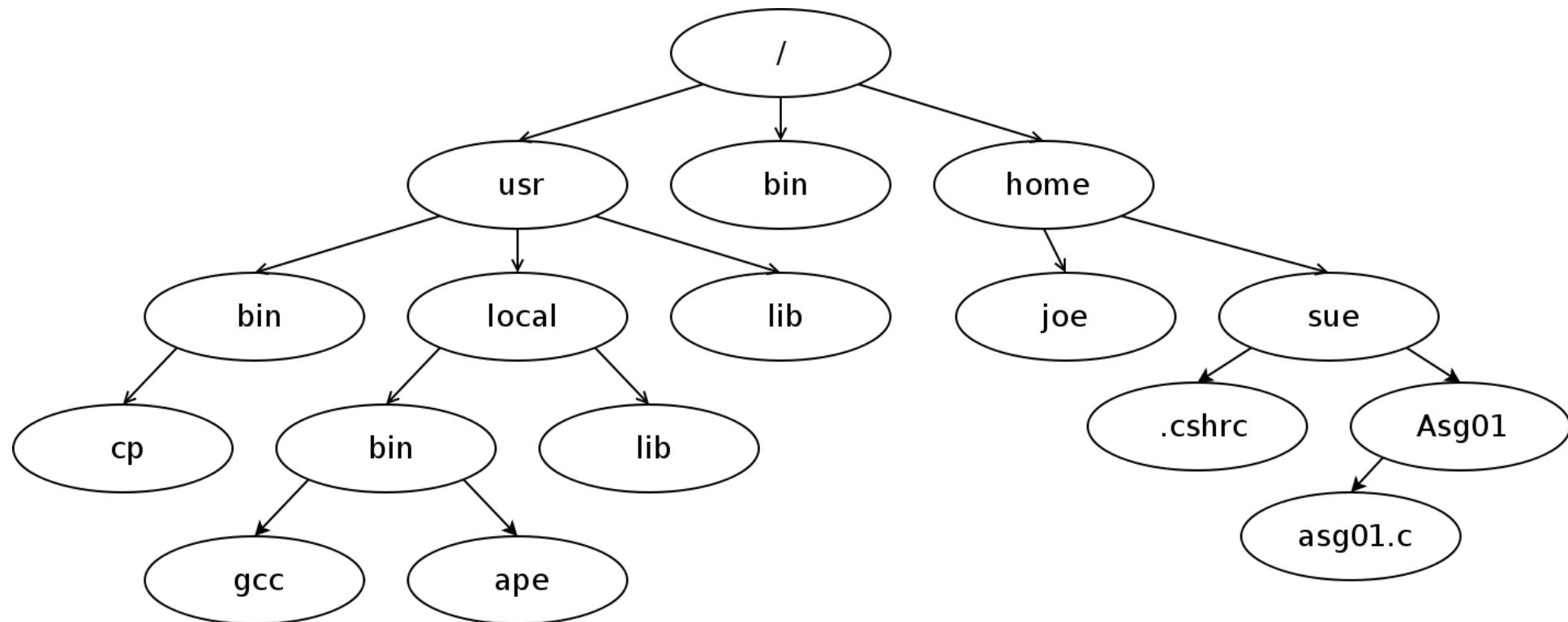
DIRECTORIES

Also referred to as "folders".

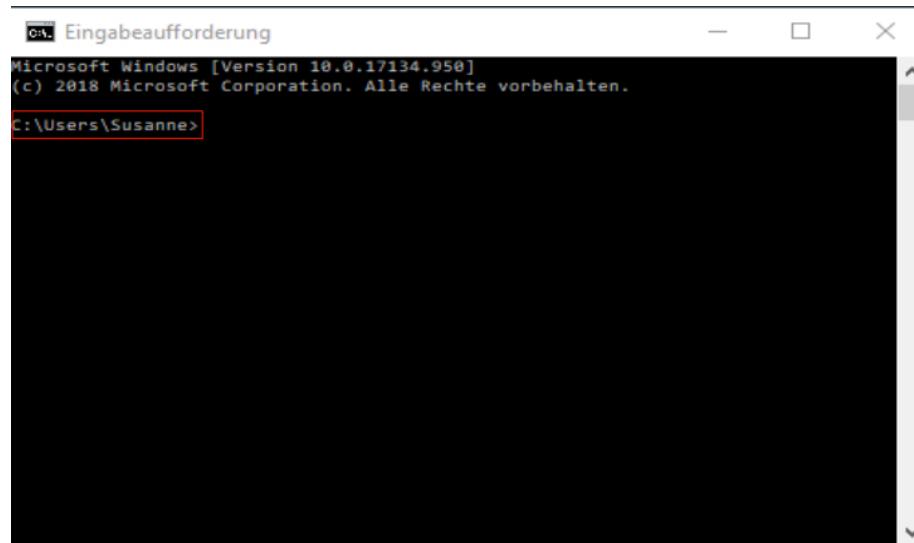
A directory is a container for files or other directories.

DIRECTORY TREES

At the very top of the tree is the root folder.



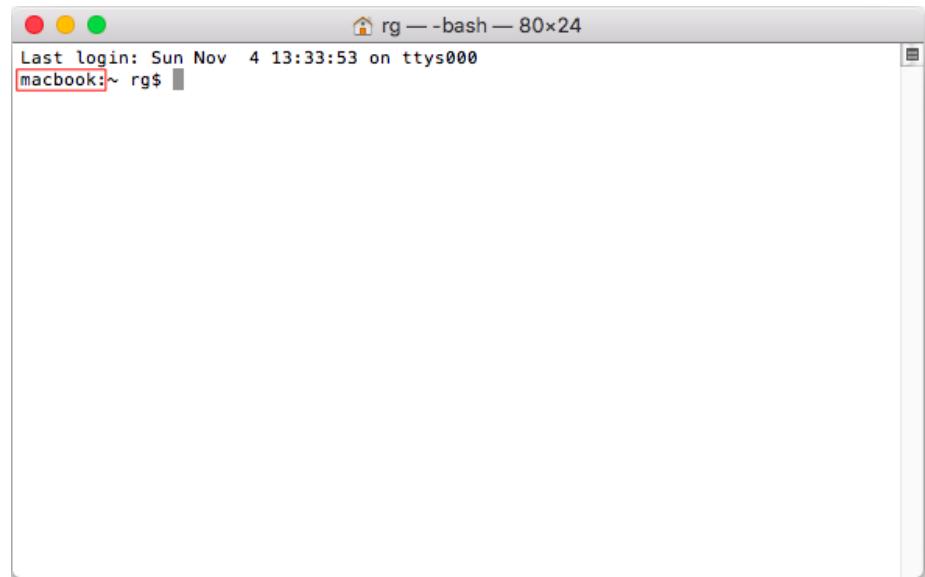
PROMPT



Eingabeaufforderung

Microsoft Windows [Version 10.0.17134.950]
(c) 2018 Microsoft Corporation. Alle Rechte vorbehalten.

```
C:\Users\Susanne>
```



rg — bash — 80x24

Last login: Sun Nov 4 13:33:53 on ttys000
macbook:~ rg\$

PROMPT

Usually shows your username and computer name.

Indicates that the terminal is ready for a command.

CURSOR

Indicates your current spot in the terminal.

Shows you where the stuff you type will go.

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- > `ls`: list all the files
- > `mkdir`: make directory
- > `rmdir`: remove/delete directory
- > `touch`: create a file
- > `rm`: remove a file
- > `pwd`: find out the file path of current directory you are in, from the root

COMMANDS & ARGUMENTS

Many commands take one or more **arguments**, which come after the command, and give detail about what the command should do.

For example, `echo` takes an argument representing the text to be repeated.

```
$ echo "This is an argument."
```

SHORTCUTS

- › Current Directory: 
- › Parent Directory: 
- › Home Directory: 
- › Previous Directory: 

Bonus: Drag a folder into the terminal to show its path.

(Only works in Visual Studio Code in Windows.)

TAB COMPLETION

Tab completion autocompletes commands and filenames.

- › Pressing **tab** once autocompletes a unique instance.
- › If there's more than one possible completion, pressing **tab** twice gives you all the options available.

TUTORIALS

- › Windows: 1 hour playlist of tutorial videos
- › OS X: Learn the command line
- › Both: Introduction to the CLI

TRY IT YOURSELF!

BUT FIRST...

YOUR PROJECT OVER THE NEXT 7 WEEKS

GOAL

Self-study and **evolve in an IT field** by working on a project a **few hours per week**. Also you will have something to show in the job interviews later on.

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For absolute beginners in web development, it is recommended to do the project in web dev.

WEB PROJECT

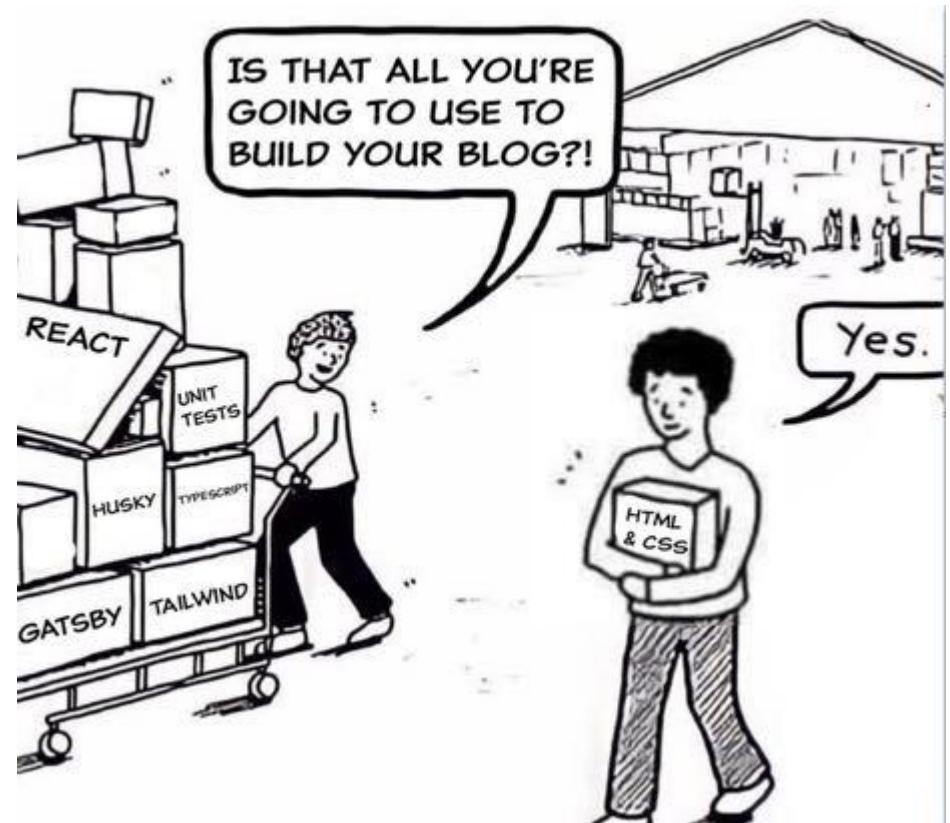
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Goal should be to use what you learn during the bootcamp.



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Ask us if you are not sure or have questions.

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Any questions?

BACK TO CLI...

TRY IT: YOUR FIRST COMMANDS

1. Open your terminal.
2. Type `echo hello` into your terminal and press **enter**.
3. Type `pwd` into your terminal and press **enter**.
4. Type `clear` into your terminal and press **enter**.

If you are stuck somewhere, try `Ctrl + C` to get back to your entry cursor.

clear

The `clear` command clears the contents of the terminal and issues a prompt.

This is good for removing previous output that is unnecessary to the task at hand.

Feel free to use this whenever things get too cluttered.

WORKING WITH DIRECTORIES

THE CURRENT DIRECTORY

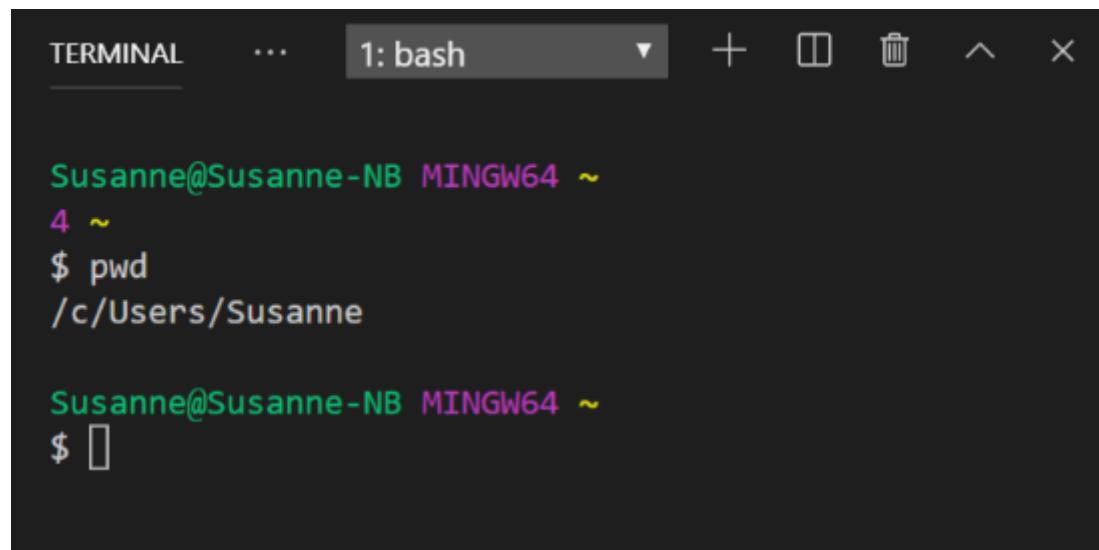
`pwd`

(Print Working Directory)

Type it whenever you want to see what directory (folder) you're in.

pwd

(Print Working Directory)



The image shows a terminal window with the title "1: bash". The terminal displays the following session:

```
Susanne@Susanne-NB MINGW64 ~
$ ~
$ pwd
/c/Users/Susanne

Susanne@Susanne-NB MINGW64 ~
$ [ ]
```

PATHS

Nested files and directories can be referenced using **paths**.

Each directory or file is separated by a forward slash /

There are two kinds of paths:

- › Relative: Desktop/the_project/overview.txt
- › Absolute: /Users/Susanne/Desktop/logo.png

cd

The `cd` command changes the current working directory.

It expects a file path as an argument.

If no file path is given, it assumes your home directory by default.

cd

TERMINAL ... 1: bash ▾ + ⌂ ⌂ ⌂ ⌂

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```

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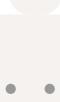
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```
$ cd ..
```

```
Susanne@Susanne-NB MINGW64 /c/Users
```

```
$ pwd  
/c/Users
```

SHORTCUTS

- › Current Directory: 
- › Parent Directory: 
- › Home Directory: 
- › Previous Directory: 

Bonus: Drag a folder into the terminal to show its path.

(Only works in Visual Studio Code in Windows.)

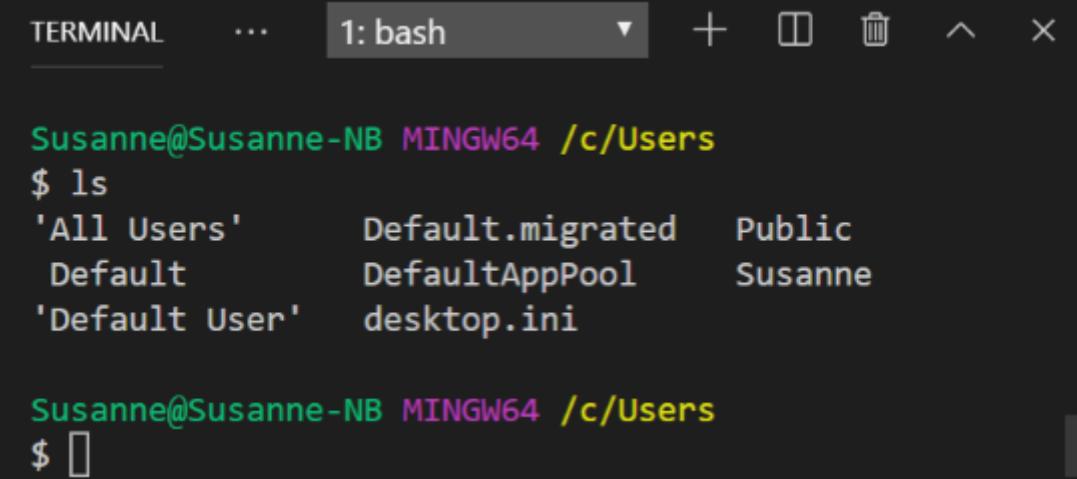
LISt

The `ls` command lists the contents of a directory.

It expects a file path as an argument.

If no file path is given, it assumes the current directory by default.

ls



A screenshot of a terminal window titled "1: bash". The window shows the command \$ ls being run, followed by a list of directory entries: 'All Users', Default.migrated, Public, Default, DefaultAppPool, Susanne, 'Default User', and desktop.ini. The terminal is running on a Windows system, as indicated by the MINGW64 prompt.

```
Susanne@Susanne-NB MINGW64 /c/Users
$ ls
'All Users'      Default.migrated    Public
Default          DefaultAppPool       Susanne
'Default User'   desktop.ini
```

```
Susanne@Susanne-NB MINGW64 /c/Users
$ 
```

FLAGS

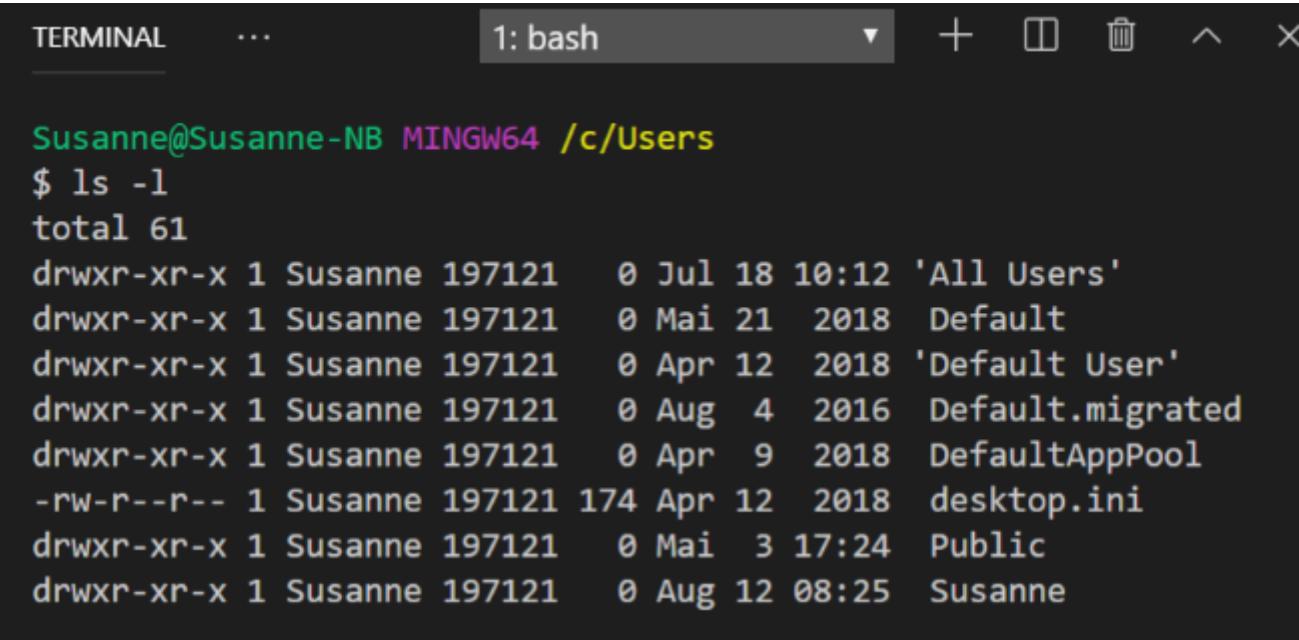
The `ls` command accepts several option flags.

A **flag** is a special argument that is used to set an option for the command.

These are commonly a hyphen followed by a single character (e.g.
`-g`)

ls -l

Setting the `-l` flag on the `ls` command causes it to provide more verbose (long) output.



The screenshot shows a terminal window titled "1: bash". The command `ls -l` is run, resulting in a detailed listing of files and directories in the current directory. The output includes file names, permissions, owner, group, last modified date, size, and modification time.

```
Susanne@Susanne-NB MINGW64 /c/Users
$ ls -l
total 61
drwxr-xr-x 1 Susanne 197121 0 Jul 18 10:12 'All Users'
drwxr-xr-x 1 Susanne 197121 0 Mai 21 2018 Default
drwxr-xr-x 1 Susanne 197121 0 Apr 12 2018 'Default User'
drwxr-xr-x 1 Susanne 197121 0 Aug 4 2016 Default.migrated
drwxr-xr-x 1 Susanne 197121 0 Apr 9 2018 DefaultAppPool
-rw-r--r-- 1 Susanne 197121 174 Apr 12 2018 desktop.ini
drwxr-xr-x 1 Susanne 197121 0 Mai 3 17:24 Public
drwxr-xr-x 1 Susanne 197121 0 Aug 12 08:25 Susanne
```

HIDDEN FILES

Filenames that begin with a period are hidden from normal output.

e.g. ".bashrc"

Use the `ls` command with the `-a` flag to see hidden files in addition to the usual output.

Type `ls -la` into your terminal.

Use the `-h` flag to get human readable file sizes.

ls -la

```
$ ls -la
total 113
drwxr-xr-x 1 Susanne 197121    0 Mai   3 17:24 .
drwxr-xr-x 1 Susanne 197121    0 Aug  29 09:48 ..
drwxr-xr-x 1 Susanne 197121    0 Jul  18 10:12 'All Users'
drwxr-xr-x 1 Susanne 197121    0 Mai  21 2018 Default
drwxr-xr-x 1 Susanne 197121    0 Apr  12 2018 'Default User'
drwxr-xr-x 1 Susanne 197121    0 Aug   4 2016 Default.migrated
drwxr-xr-x 1 Susanne 197121    0 Apr   9 2018 DefaultAppPool
-rw-r--r-- 1 Susanne 197121 174 Apr  12 2018 desktop.ini
drwxr-xr-x 1 Susanne 197121    0 Mai   3 17:24 Public
drwxr-xr-x 1 Susanne 197121    0 Aug  12 08:25 Susanne
```

TAB COMPLETION

Tab completion autocompletes commands and filenames.

- › Pressing **tab** once autocompletes a unique instance.
- › If there's more than one possible completion, pressing **tab** twice gives you all the options available.

TRY IT YOURSELF

Play with the `cd` and `ls` commands.

Be sure to incorporate:

- > relative and absolute file path
- > the `.` shortcut
- > the `..` shortcut
- > the `~` shortcut
- > `cd` without an argument

Use `pwd` to check your location periodically.

Use Tab completion to autocomplete commands and filenames.

MAKE A DIRECTORY

Use `mkdir` to create a new empty directory.

Pass the path of the directory name as the first argument.

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If the base of the path doesn't already exist, the command will fail.

MAKE A DIRECTORY

Use `mkdir` to create a new empty directory.

Pass the path of the directory name as the first argument.

If the base of the path doesn't already exist, the command will fail.

Use the `-p` flag to create the full path if non-existent.

mkdir

```
Susanne@Susanne-NB MINGW64 ~/Desktop
$ mkdir powercoders

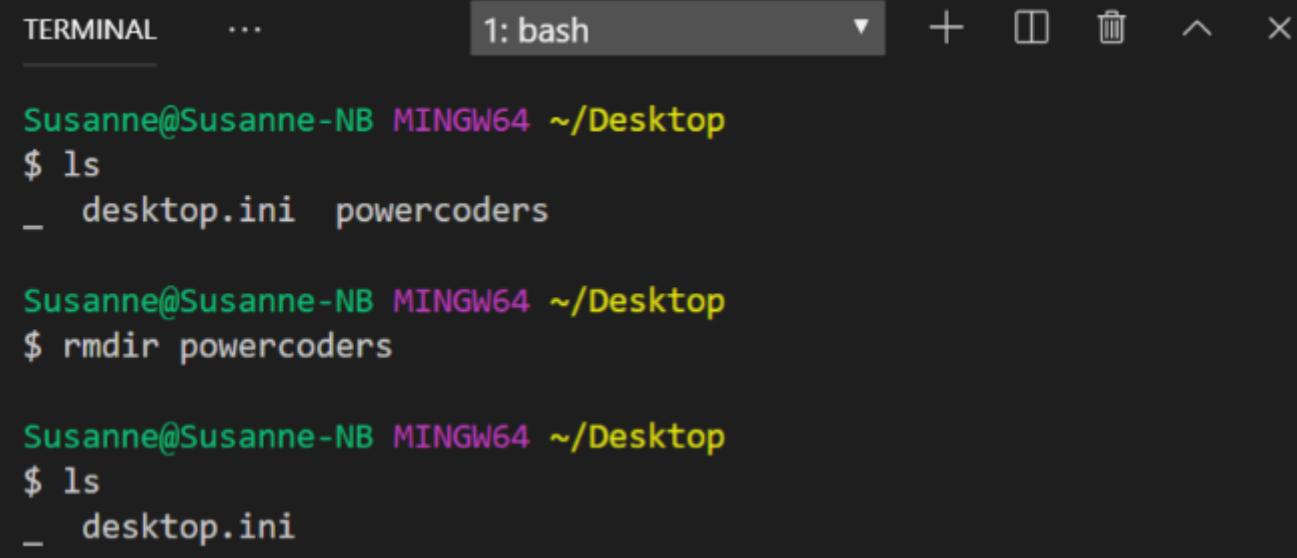
Susanne@Susanne-NB MINGW64 ~/Desktop
$ ls
- desktop.ini powercoders
```

REMOVE A DIRECTORY

Use `rmdir` to remove an empty directory.

Use `rm -r` to remove a non-empty directory.

rmdir



The screenshot shows a terminal window with the title "1: bash". The terminal displays the following session:

```
Susanne@Susanne-NB MINGW64 ~/Desktop
$ ls
- desktop.ini  powercoders

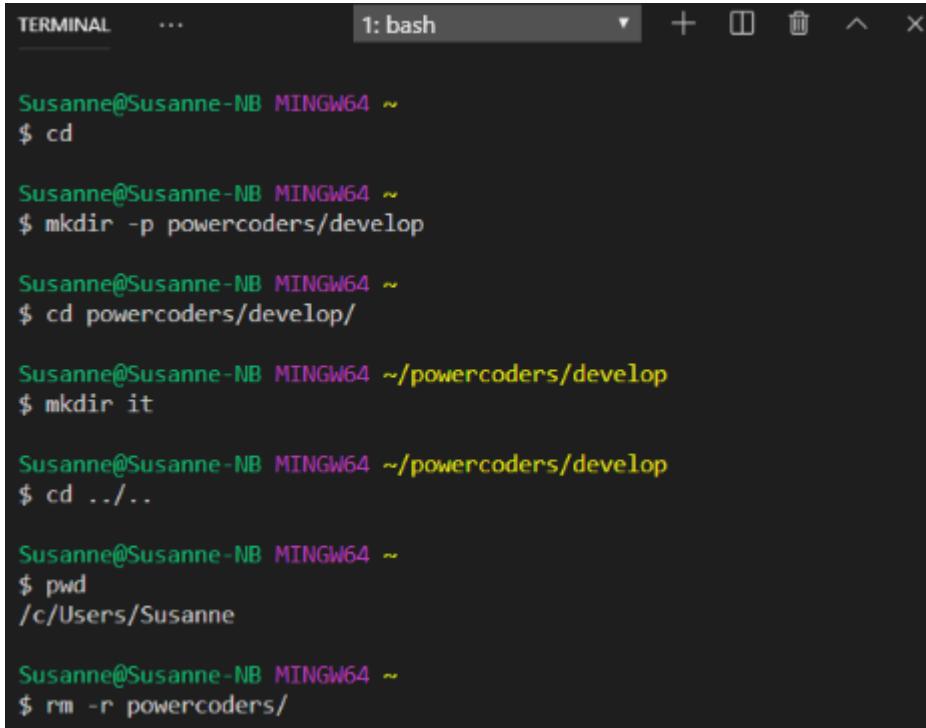
Susanne@Susanne-NB MINGW64 ~/Desktop
$ rmdir powercoders

Susanne@Susanne-NB MINGW64 ~/Desktop
$ ls
- desktop.ini
```

TRY IT YOURSELF

1. `cd` to your home directory.
2. Create the **powercoders/develop** directory path.
3. Navigate into the **powercoders/develop** directory.
4. Create the **it** directory.
5. Navigate up two directories.
6. Use the `pwd` command to verify you are home.
7. Remove the **powercoders/develop/it** path.

TRY IT YOURSELF



The image shows a terminal window with a dark background and light-colored text. The title bar says "1: bash". The terminal content is as follows:

```
Susanne@Susanne-NB MINGW64 ~
$ cd

Susanne@Susanne-NB MINGW64 ~
$ mkdir -p powercoders/develop

Susanne@Susanne-NB MINGW64 ~
$ cd powercoders/develop/

Susanne@Susanne-NB MINGW64 ~/powercoders/develop
$ mkdir it

Susanne@Susanne-NB MINGW64 ~/powercoders/develop
$ cd ../..

Susanne@Susanne-NB MINGW64 ~
$ pwd
/c/Users/Susanne

Susanne@Susanne-NB MINGW64 ~
$ rm -r powercoders/
```

WORKING WITH FILES

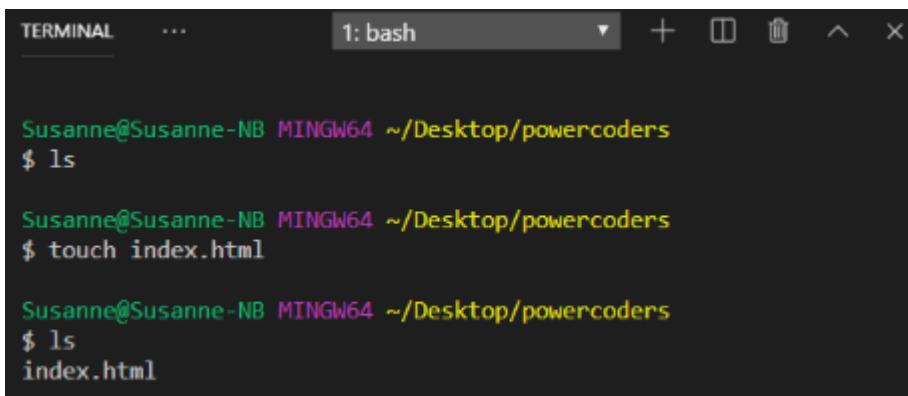
CREATE A FILE

Use **touch** to create a new file.

The **touch** touch command expects the name of your new file as an argument.

touch

(create a file)



A screenshot of a terminal window titled "1: bash". The terminal shows the following session:

```
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders
$ ls
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders
$ touch index.html
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders
$ ls
index.html
```

COPY A FILE

Use `cp` to copy a file.

The `cp` command takes two arguments:

- › 1st argument = the "origin" file
- › 2nd argument = the "destination" file

```
$ cp resume.txt resume-copy.txt
```

Use `cp -R` to copy a whole directory and all files in it.

cp

(copy a file)

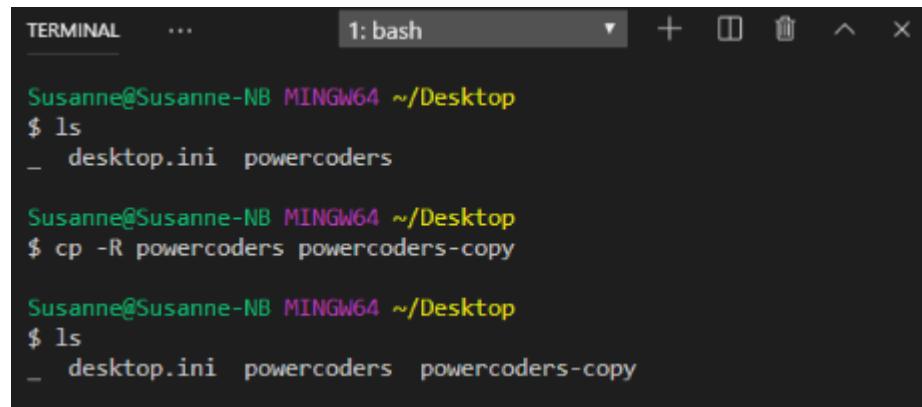
cp origin destination

```
TERMINAL ... 1: bash + □ ^ ×  
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders  
$ ls  
index.html  
  
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders  
$ cp index.html copy.html  
  
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders  
$ ls  
copy.html index.html
```

cp -R

(copy a whole directory)

cp -R origin destination



The screenshot shows a terminal window with the following session:

```
TERMINAL ... 1: bash + □ ^ ×  
Susanne@Susanne-NB MINGW64 ~/Desktop  
$ ls  
_ desktop.ini powercoders  
  
Susanne@Susanne-NB MINGW64 ~/Desktop  
$ cp -R powercoders powercoders-copy  
  
Susanne@Susanne-NB MINGW64 ~/Desktop  
$ ls  
_ desktop.ini powercoders powercoders-copy
```

The terminal interface includes a tab bar with "1: bash", a toolbar with icons for new tab, close, etc., and a status bar at the bottom.

Moving (or Renaming) A FILE/DIRECTORY

Use `mv` to move a file or directory.

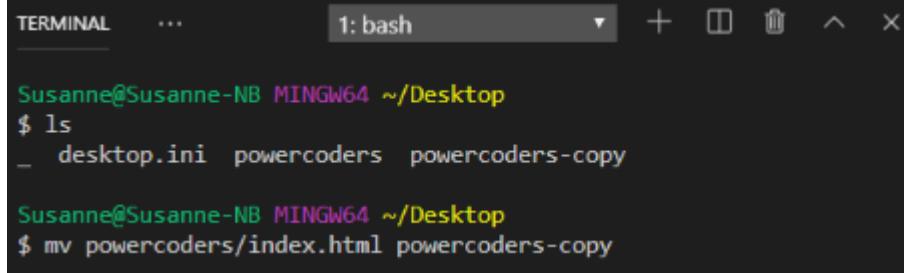
The `mv` command takes two arguments:

- › 1st argument = the "origin"
- › 2nd argument = the "destination"

If the destination is a filename, the file will be renamed.

MOVE A FILE/DIRECTORY

```
mv origin destination
```



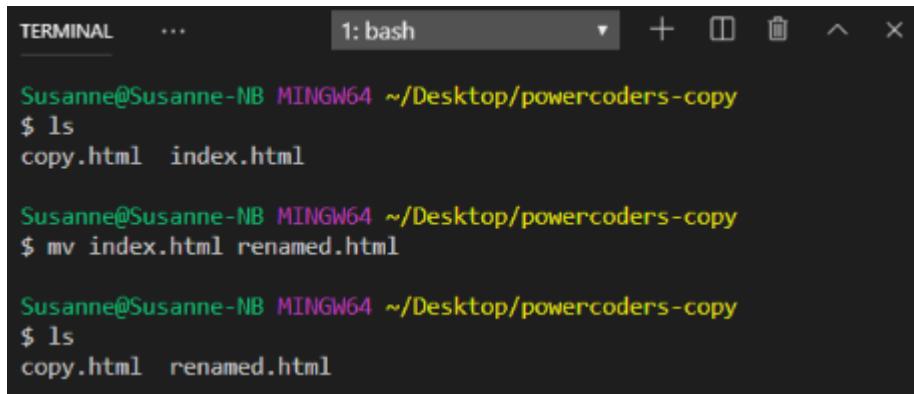
A screenshot of a terminal window titled "1: bash". The window shows a command-line interface with the following history:

```
TERMINAL ... 1: bash
Susanne@Susanne-NB MINGW64 ~/Desktop
$ ls
desktop.ini powercoders powercoders-copy
Susanne@Susanne-NB MINGW64 ~/Desktop
$ mv powercoders/index.html powercoders-copy
```

The terminal window has a dark background and light-colored text. It includes standard terminal navigation icons at the top right.

RENAME A FILE/DIRECTORY

```
mv origin destination(filename)
```



The screenshot shows a terminal window with the following session:

```
TERMINAL ... 1: bash + ⌂ ⌄ ⌅ ⌆ ⌇ ⌈ ⌉ ⌊ ⌋
```

```
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ ls
copy.html index.html

Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ mv index.html renamed.html

Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ ls
copy.html renamed.html
```

The terminal window has a dark background and light-colored text. The prompt shows the user is in a directory named "powercoders-copy". The first command lists files "copy.html" and "index.html". The second command renames "index.html" to "renamed.html". The final command lists the files again, showing "copy.html" and "renamed.html".

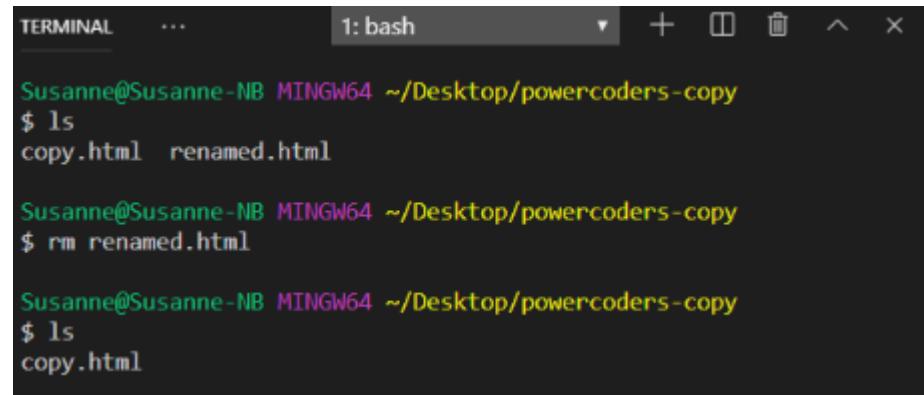
REMOVE A FILE

Use `rm` to remove a file.

The `rm` command takes the name of the file you are removing as an argument.

rm

(remove a file)



The image shows a terminal window with the title "1: bash". The terminal displays the following session:

```
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ ls
copy.html  renamed.html

Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ rm renamed.html

Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders-copy
$ ls
copy.html
```

TRY IT YOURSELF

1. Create a folder called **cli**.
2. Make that folder your current working directory.
3. Create two files: **file1.txt**, **file2.txt**.
4. Copy **file1.txt** and call the copy **file3.txt**.
5. Create a directory called **folder1**.
6. Move **file1.txt** into **folder1**.
7. List the contents of **folder1** without going into it.
8. Rename **file1.txt** to **myfile.txt**.
9. Remove the directory **folder1**, including the file inside.

READ A FILE

Use `cat` to output the contents of a file to the console.

Use `more` to step through the contents of a file one screen at a time.

Use `less` to step backwards or forwards.

Use `q` to get out of the `less`.

OPEN A FILE/DIRECTORY

Use `open` to open a file or directory in its default app—the equivalent of double-clicking it.

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(Sadly, this does not work in Windows. 😞)

OPEN A FILE/DIRECTORY

Use `open` to open a file or directory in its default app—the equivalent of double-clicking it.

(Sadly, this does not work in Windows. 😞)

Pass the path of the file or directory name as the argument.

OPEN A FILE/DIRECTORY

Use `code .` to open the current directory in VSC.

Use `code` plus filename to open a specific file of the current directory in Visual Studio Code (VSC).



```
TERMINAL ... 1: bash + □ ^ x
Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders
$ code .

Susanne@Susanne-NB MINGW64 ~/Desktop/powercoders
$ code index.html
```

A screenshot of a terminal window titled 'TERMINAL'. It shows two command-line entries. The first entry is '\$ code .' which opens the current directory. The second entry is '\$ code index.html' which opens the 'index.html' file within the current directory. The terminal has a dark background with light-colored text and icons.

EDIT A FILE

You can use various editors built into bash, including `vi` and `nano`.

Enter the editor command and the file path:

```
$ nano myfile.txt
```

Or on a Mac, you can open with any desktop app:

```
open -aTextEdit myfile.txt
```

Or with the default editor:

```
$ open -t myfile.txt
```

TRY IT YOURSELF

1. Navigate to the **powercoders** directory you made before.
2. Use `vi` or `nano` to add a few sentences to **file2.txt**, then exit and save.
3. Mac users, read the new contents of **file2.txt** in your terminal.
4. Everyone, try using `code` to open **file2.txt** in Visual Studio Code.

WORKING WITH COMMANDS

COMMAND LINE MOVEMENT

- › **ctrl-a**: jump to beginning of line
- › **alt-f**: jump forward a word
- › **alt-b**: jump back a word
- › **alt-d**: delete word
- › **alt-t**: transpose two words

MORE COMMAND LINE MOVEMENT

- › The ← and → arrow keys let you edit within a command
- › The ↑ and ↓ arrow keys let you select previous commands
- › tab auto-completes filenames and directories

```
$ cd ~/pr[TAB]ojects/ac[TAB]medesign/doc[TAB]umentation/
```

COMMAND LINE HISTORY

Use the `history` command to see a list of all your previous commands.

Each command will be listed next to a line number.

A few history-related commands:

- › `!!`: Latest command
- › `!54`: Command by line number
- › `!code`: Command matching a string

history

```
TERMINAL ... 1: bash + □ ^ ×  
48 clear  
49 clear  
50 echo hello  
51 clear  
52 echo hello  
53 echo "maamam"  
54 date  
55 echo "maamam"  
56 time echo "maamam"  
57 history
```

TRY IT YOURSELF

1. Use your up and down arrows to locate a past command with one or more arguments.
2. Move your cursor to the beginning of the line.
3. Move your cursor from word to word to the end of the line.
4. Change one of the arguments and run it.
5. Run the date command.
6. Re-run the command from step 4 using !.
7. Time the execution of your original command by running time !!.

TROUBLESHOOTING

WHAT CAN GO WRONG?

- > Mis-spell a command: `aaaaaaaa` ('a' x 8)
- > `cd` in to a directory that does not exist
- > `cd ...`
- > `cd .`
- > `cd filename`
- > `rmdir aaaaaaaaa`

WHERE'S THE PROMPT?!

Different processes have different ways of exiting back to the prompt. If you're stuck, try one of these:

- › **ctrl + c**
- › **ctrl + x**
- › **q**
- › **:q**
- › **esc key, then :q**

command not found

If you receive a `command not found` error message, check for typos!

command not found

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Otherwise, you may need to install the software that uses the command.

command not found

If you receive a **command not found** error message, check for typos!

Otherwise, you may need to install the software that uses the command.

Try searching online for:

“ how to install [command-name-here] on
[Mac/Windows/Linux]

CHEATSHEET

Action	Windows	OS X
Print working directory	cd	pwd
List directory contents	dir	ls
Change to a subdirectory	cd dir	cd dir
Go up a directory	cd ..	cd ..
Create a directory	mkdir dir	mkdir dir
Delete a directory	rmdir dir	rmdir dir

... and many more on **following cheat sheet**

FURTHER MATERIAL

- › CLI Challenge
- › Networking in detail
- › BGP visualized

