

## Reviewing binary

- 'bit' = ***b***inary ***i***g***t***
- Bits represent electricity; like a light switch

Below are 4 bits and there are a total of 16 possible combinations

8	4	2	1	decimalVal
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

In the chart below, there are 3 binary digits or '3 *bits*'

- There are a total of 8 possible combinations

- Linux file permissions use just 3 bits to represent all the

4	2	1	decimalVal
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

4	2	1	Permissions	Meaning (Least access -to- greatest access)	Shown in dir list Listing as...
Read "r"	Write "w"	Execute "x"			
0	0	0	0	No access	- - -
0	0	1	1	Execute-only	- - x
0	1	0	2	Write-only	- w -
0	1	1	3	Write and Execute	- w x
1	0	0	4	Read-only	r - -
1	0	1	5	Read and Execute	r - x
1	1	0	6	Read and Write	r w -
1	1	1	7	Read-Write-Execute	r w x

```
# ls -l file
-rw-r--r-- 1 root root 0 Nov 19 23:49 file
```

Owner (rw-)  
Group (r- -)  
Other (r - -)

r = Readable  
w = Writeable  
x = Executable  
- = Denied

File type

- Each Linux file has 3 attributes; Owner, Group, and Other.
- Each attribute has its own permission level
- Those permissions are expressed at the beginning of a file listing as something like 'rwxrwxrwx' or 'rw-r--r--', etc."

Columns													Meaning	
(Owner) User	Group	(Everyone) Other	Decimal Value Used in the chmod command	U   G   O	Links	User	Group	Bytes	Month	Day	Time/Year	FileName		
r w x	r w x	r w x	777	rwxrwxrwx	1	pi	pi		28	Jul	3	20:39	Learn001.py	Anyone can read, write, and execute
r w x	r x	r x	755	rw-r-xr-x	1	root	root	184	Jul	9	20:55	cmdline.txt	Owner can read, write, execute Both Group and Other can read and Execute, but they can't write	
r w x	r w x	r x	775	rwxrwxr-x	1	root	root	184	Jul	9	20:55	config.txt	Owner can read, write, execute Both Group and Other can read and Execute, but they can't write	
r w -	r - -	r - -	644	rw-r--r--	1	root	root	861	Jul	3	20:31	.bash_aliases	Owner can read and write, but not execute. Both Group and Other can read but they can't write or execute	
r - -	r - -	r - -	444	r--r--r--	1	root	root	2.2K	Mar	26	2019	python.mk	Everyone can read but no one can write or execute	

- 'chmod' = *change mode*
- This command is used to change permission modes in Linux-based file systems
- The command is used by starting with **chmod** followed by a 3-digit number for the access level like ... **777** ... followed by a file name like ... **python.mk**

For example: `chmod 777 cmdline.txt`

This will change the permissions of the cmdline.txt file to `'rwx rwx rwx'` so that anyone can read, write, or execute the cmdline.txt file.

Columns															
(Owner)		(Everyone)	Decimal Value										chmod commands	Meaning	
User	Group	Other	Used in the chmod command	U   G   O	Links	User	Group	Bytes	Month	Day	Time/Year	FileName			
r w x	r w x	r w x	777	rw-rw-rwx	1	pi	pi		28	Jul	3	20:39	Learn001.py	chmod 777 Learn001.py	Anyone can read, write, and execute
r w x	r x	r x	755	rw-r-xr-x	1	root	root	184	Jul	9	20:55	cmdline.txt	chmod 755 cmdline.txt		Owner can read, write, execute Both Group and Other can read and Execute, but they can't write
r w x	r w x	r x	775	rw-rwxr-x	1	root	root	184	Jul	9	20:55	config.txt	What command would you use to grant read-only access to owner a NO access to anyone else for this file?		Owner can read, write, execute Both Group and Other can read and Execute, but they can't write
r w -	r - -	r - -	644	rw-r--r--	1	root	root	861	Jul	3	20:31	.bash_aliases	What command would you use to grant full access to everyone for this file?		Owner can read and write, but not execute. Both Group and Other can read but they can't write or execute
r - -	r - -	r - -	444	r--r--r--	1	root	root	2.2K	Mar	26	2019	python.mk	What command would you use to make this file only executable for Other and NOT readable or writable by anyone else. Hint: --x--x--x		Everyone can read but no one can write or execute

Symbolic Method (Short-hand for changing single attributes / less intuitive, lots of typing! )

- 'chmod' = *change mode*
- The symbolic command is used to change just one or two permission bit... often seen in instructions to temporarily change permissions.
- The command is used by starting with "**chmod**" followed by:
  - a letter representing the specific permission type (**u**ser, **g**roup, or **o**ther)
  - a "+" or a "-" to add or remove a permission
  - and then a letter, r, w, or x to specify the type of permission to add or remove.

For example: If we need to temporarily modify *my-file.conf* to make it writeable (744) and it's usually set for read only (644):

`chmod u+x my-file.conf;` (hint: You can verbalize this as "Change mode, **U**ser, add **eX**ecute bit")

*To revert it afterwards: `chmod u-x my-file.conf`*

(Owner) User	Group	(Everyone) Other	Decimal Value Used in the chmod command	Columns U   G   O   Links User   Group   Bytes   Month   Day Time/Year   FileName	chmod commands	Verbalize as ...
r w x	r w x	r w x	777	rw-rw-rw- 1 pi pi 28 Jul 3 20:39 Learn001.py	chmod u+r,u+w,u+x,g+r,g+w,g+x,o+r,o+w,o+x Learn001.py	Change mode, for <b>user</b> add read, add write, add execute, for <b>group</b> add read, add write, add execute, for <b>other</b> add read, add write, add execute.
r w x	r x	r x	755	rw-r-xr-x 1 root root 184 Jul 9 20:55 cmdline.txt	chmod u+r,u+w,u+x,g+r,g+x,o+r,o+x cmdline.txt	Change mode, for <b>user</b> add read, add write, add execute, for <b>group</b> add read, add execute, for <b>other</b> add read, add execute.
r w x	r w x	r x	775	rw-rwxr-x 1 root root 184 Jul 9 20:55 config.txt	What command would you use to grant read-only access to owner a NO access to anyone else for this file?	Change mode, for <b>user</b> add read, add write, add execute, for <b>group</b> add read, add write, add execute, for <b>other</b> add read, add execute.
r w -	r - -	r - -	644	rw-r--r-- 1 root root 861 Jul 3 20:31 .bash_aliases	What command would you use to grant full access to everyone for this file?	?
r - -	r - -	r - -	444	r--r--r-- 1 root root 2.2K Mar 26 2019 python.mk	What command would you use to make this file only executable for Other and NOT readable or writable by anyone else. Hint: --x--x--x	?