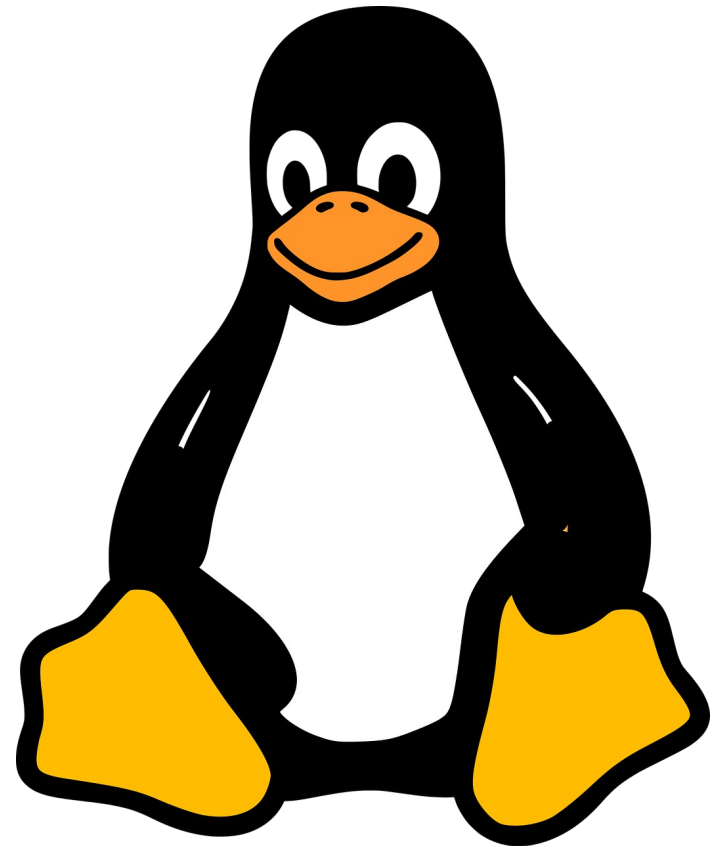# HackerFrogs Afterschool
Linux Basics /w PicoCTF: Part 3

Class:
Linux OS Operations

Workshop Number:
AS-LIN-03

Document Version:
1.9

Special Requirements:
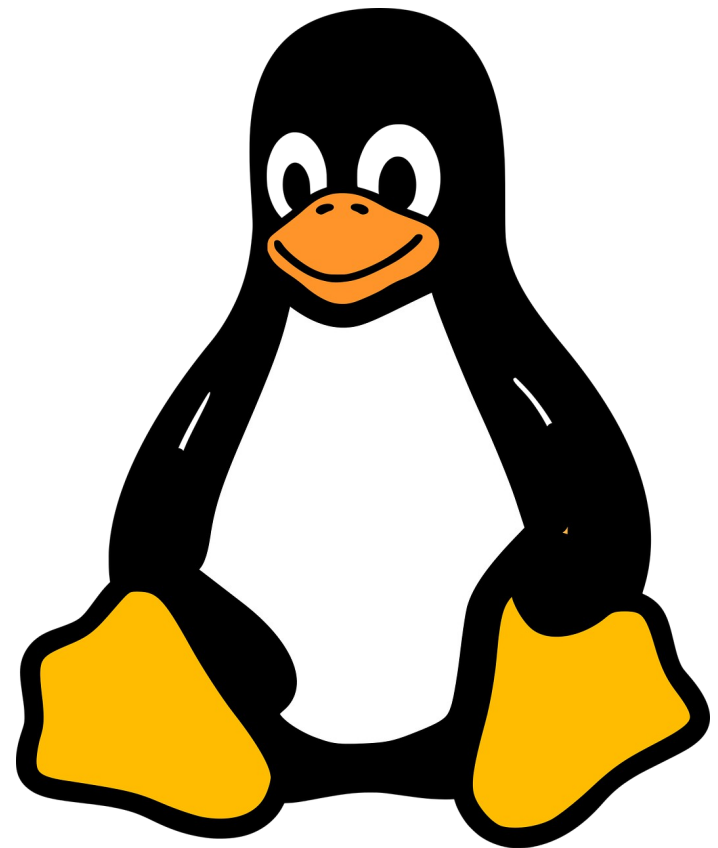Completion of AS-LIN-02

What We Learned In The Previous Workshop

Hey there HackerFrogs!

This is the third intro to Linux OS Operations workshop.

In the previous workshop we learned about the following Linux commands:

Find Command

The Find command is used to search for files on the system. It can used with many different arguments and flags to refine the search parameters.

Grep Command

The Grep command searches within the contents of files for specified strings. It is very commonly used to pick out specific words or phrases.

Mkdir Command

The **mkdir** command is used to create new directories in the current directory. The syntax for the command is as follows:

```
mkdir <new_directory_name>
```

For example

```
mkdir firstfind
```

Rm Command

The rm command is used to delete files or directories, but deleting directories requires the use of the **-r** flag:

```
rm -r firstfind
```

Let's Continue Where We Left Off!

Let's solve the "what's a net cat?" challenge at PicoCTF:

https://play.picoctf.org/practice/challenge/34

Netcat Command

Netcat is a versatile computer networking program, and one common use of netcat (with picoCTF challenges) is to connect to non-standard services on remote servers

Netcat Command

The syntax for using Netcat to connect to a remote server on a specific port is as follows:

```
nc <ip_address_or_domain> <port_number>
```

For example

```
nc jupiter.challenges.picoctf.org 41120
```

PicoCTF Plumbing Challenge

Let's learn about command piping with the PicoCTF Plumbing challenge:

https://play.picoctf.org/practice/challenge/48

Command Piping

```
nc jupiter.challenges.picoctf.org 4427 | grep pico
```

In Linux, command piping is the process of passing the output of one command into the input of a second command.
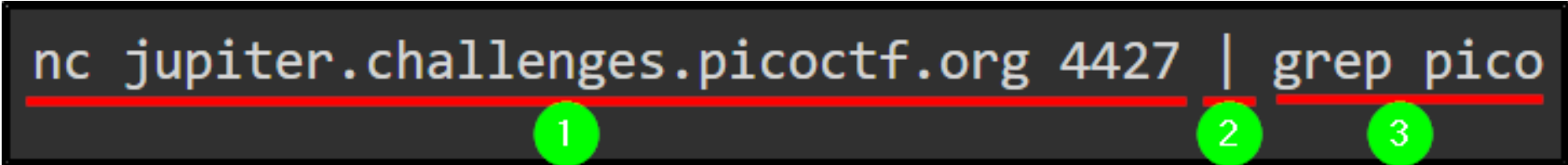
Command Piping

```
nc jupiter.challenges.picoctf.org 4427 | grep pico
```

This is a very useful feature, because it allows commands to be chained together to achieve a lot of flexible output.

Command Piping

```
nc jupiter.challenges.picoctf.org 4427 | grep pico
```

1 – The first command
2 – The pipe
3 – The second command

Command Piping

```
nc jupiter.challenges.picoctf.org 4427 | grep pico
```

So this runs the Netcat command, and the output of the command is passed to the grep command, which searches the output for the "pico" string.

PicoCTF Bases Challenge

Let's learn about Base64 encoding with the PicoCTF Plumbing challenge:

https://play.picoctf.org/practice/challenge/67

Base64 Command

The Base64 command encodes / decodes data according to the Base64 codec. It is often used to convert data for transmission across computer networks.

0	A	16	Q	32	g	48	w
1	B	17	R	33	h	49	x
2	C	18	S	34	I	50	y
3	D	19	T	35	j	51	z
4	E	20	U	36	k	52	0
5	F	21	V	37	l	53	1
6	G	22	W	38	m	54	2
7	H	23	X	39	n	55	3
8	I	24	Y	40	o	56	4
9	J	25	Z	41	p	57	5
10	K	26	a	42	q	58	6
11	L	27	b	43	r	59	7
12	M	28	c	44	s	60	8
13	N	29	d	45	t	61	9
14	O	30	e	46	u	62	+
15	P	31	f	47	v	63	/

Base64 Command

The Base64 command encodes / decodes data according to the Base64 codec. It is often used to convert data for transmission across computer networks.

0	A	16	Q	32	g	48	w
1	B	17	R	33	h	49	x
2	C	18	S	34	I	50	y
3	D	19	T	35	j	51	z
4	E	20	U	36	k	52	0
5	F	21	V	37	l	53	1
6	G	22	W	38	m	54	2
7	H	23	X	39	n	55	3
8	I	24	Y	40	o	56	4
9	J	25	Z	41	p	57	5
10	K	26	a	42	q	58	6
11	L	27	b	43	r	59	7
12	M	28	c	44	s	60	8
13	N	29	d	45	t	61	9
14	O	30	e	46	u	62	+
15	P	31	f	47	v	63	/

Base64 Command

The characters used in Base 64 encoding are shown here. Note that all Base 64 encoded strings must consist of a number of characters that is divisible by 4.
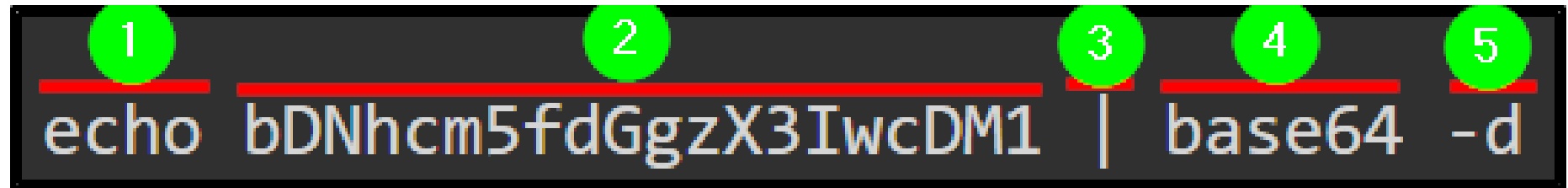
0	A	16	Q	32	g	48	w
1	B	17	R	33	h	49	x
2	C	18	S	34	I	50	y
3	D	19	T	35	j	51	z
4	E	20	U	36	k	52	0
5	F	21	V	37	l	53	1
6	G	22	W	38	m	54	2
7	H	23	X	39	n	55	3
8	I	24	Y	40	o	56	4
9	J	25	Z	41	p	57	5
10	K	26	a	42	q	58	6
11	L	27	b	43	r	59	7
12	M	28	c	44	s	60	8
13	N	29	d	45	t	61	9
14	O	30	e	46	u	62	+
15	P	31	f	47	v	63	/

Base64 Command

```
└─$ echo -n password | base64
cGFzc3dvcmQ=
```

In cases where an encoded string is not divisible by 4, the encoding process will "pad out" the string with equal symbols until the string is divisible by 4.

Base64 Command

1 – The echo command
2 – Input for echo command
3 – The pipe
4 – Base64 command
5 – The base64 decode switch

Echo Command

The **echo** command is used to create output equal to whatever is supplied to it.

It can be used to supply input to another command through command piping
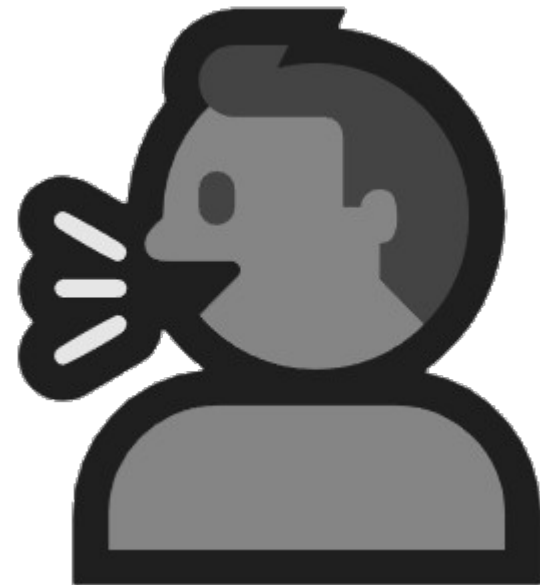
Echo Command

For example, this is an example of the echo command used to supply input to the base64 command:

```
echo 'base64_encode_test' | base64
```

Echo Command

The **echo** command can also be used to create files containing the echo content by combining it with output redirection. For example:
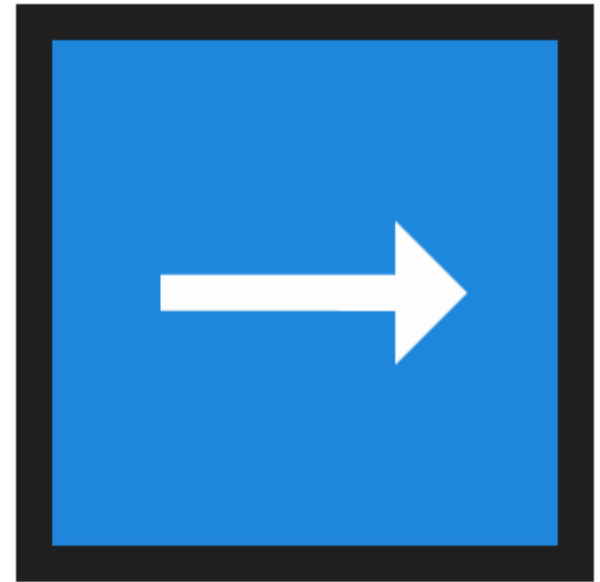
```
echo test > output.txt
```

The above command creates a file called **output.txt** with the text content "test"

Output Redirection

Output redirection is a feature in Linux which can be used to direct the output of commands and write that output to a file.

The previous echo command was an example of this

Output Redirection

```
find / -name *.jpg > jpg_file_list.txt
```

The above command takes the output of the find command, and redirects that into a file called **jpg_file_list.txt**.

This is a useful technique that can be used to save the output of commands for later use.

PicoCTF Repetitions Challenge

Let's practice the concepts we've learned this session with the PicoCTF Repetitions challenge:

https://play.picoctf.org/practice/challenge/67

Summary

Let's review the Linux commands we learned in this workshop:

Netcat Command

Netcat is a versatile computer networking program, and one common use of netcat (with picoCTF challenges) is to connect to non-standard services on remote servers

Command Piping

Command piping is the process of passing the output of one command into the input of a second command (via use of the Linux pipe | character)

Base64 Command

The Base64 command encodes / decodes data according to the Base64 codec format. It is often used to convert data for transmission across computer networks.

| 0	A	16	Q	32	g	48	w
1	B	17	R	33	h	49	x
2	C	18	S	34	I	50	y
3	D	19	T	35	j	51	z
4	E	20	U	36	k	52	0
5	F	21	V	37	l	53	1
6	G	22	W	38	m	54	2
7	H	23	X	39	n	55	3
8	I	24	Y	40	o	56	4
9	J	25	Z	41	p	57	5
10	K	26	a	42	q	58	6
11	L	27	b	43	r	59	7
12	M	28	c	44	s	60	8
13	N	29	d	45	t	61	9
14	O	30	e	46	u	62	+
15	P	31	f	47	v	63	/

Echo Command

The **echo** command is used to create output equal to whatever is supplied to it.

It can be used to supply input to another command through command piping
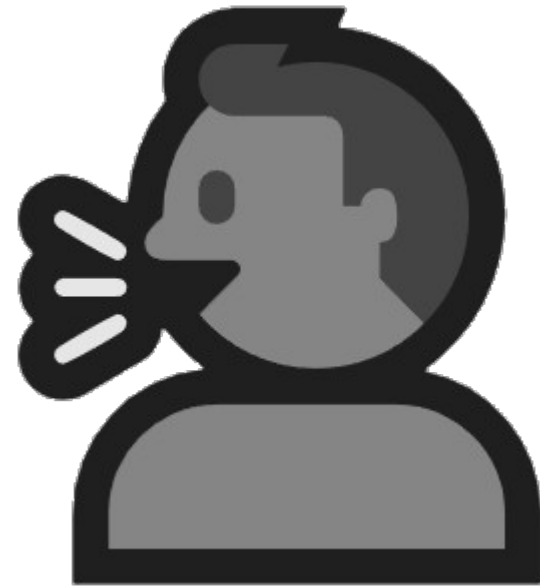
Output Redirection

Output redirection is a feature in Linux which can be used to direct the output of commands and write that output to a file.
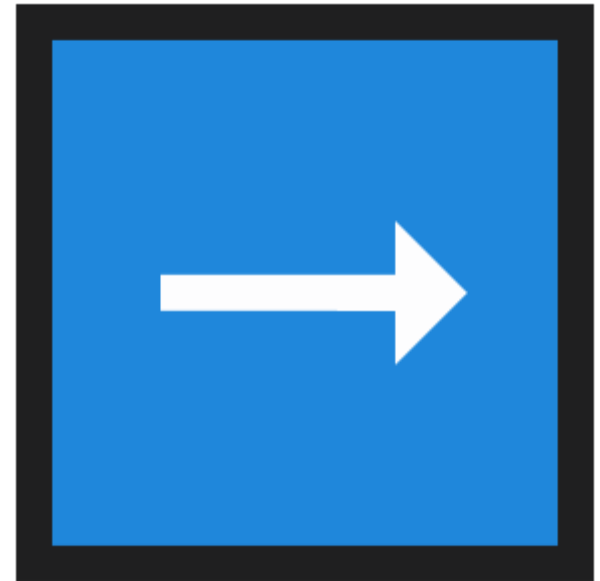
What's Next?

In the next Linux OS operations workshop, we'll keep learning about Linux commands through the PicoCTF platform.

Extra Credit

Looking for more study material on this workshop's topics?

See this video's description for links to supplemental documents and exercises!

Until Next Time, HackerFrogs!