Linux Basics

COMPASS CTF

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Overview

Linux was first released in September 17, 1991 by Linus Torvalds. Strictly speaking Linux is just the kernel in the GNU/Linux operating system. Linux is the most installed OS in the world, that is mainly due to the fact that android use Linux as its OS. It is leading in pretty much all markets except for the desktop-market.

From a infosec perspective there are two reasons we should learn Linux. The first is that the majority of all servers in the world is running on Linux. And if we want to hack those servers we of course have to understand how they work. The second reason is that the vast majority of all hacking-tools are only available on Linux.

So in this chapter we are going to look at bit at some basic commands and basics of Linux. Of course your can write quite a few books about Linux, so this tiny little introduction is just way to get you started. And also, I am just a beginner myself so I am just writing stuff that I myself need to learn.

Overview

Although there is only one Linux Kernel there are many Linux Distributions, that is: different versions. That is because the GNU/Linux OS is a mix of GNU software and the Linux Kernel. The GNU/Linux OS can be packaged in a million different ways, with different software preinstalled, with different configurations, with different Graphical User Interface (GUI). The fact that you can configure the OS however you like has given rise to the many different versions. These different versions are usually called distros. There are hundreds of different distros. Some common ones are: Ubuntu, Debian, Redhat, CentOS and Arch.

Overview

So you probably wonder what the main differences are. Here is a list of some differences:

- Package management program.
- Speed and interval of release
- Desktop environment
- Default GUI
- Community
- Compilation of the Linux Kernel

Overview

So as you can see depending on the users needs you can choose the distro that fits you best. Some people want to have bleeding-edge (the latest updates - although a bit more unstable) and others prefer stability. Some people want a distro with higher degree of security. Others want a distro with only free software, others want distros specially made for kids, or for education, or for scientists. One distro that is common among pentesters is Kali Linux. It comes preinstalled with hundreds of different pentesting-related tools. It might not be the best distro for everyday use. But for pentesting is is really convenient. Of course you could just download the programs to your non-kali distro as you go along. But it might be just an unneccesary hassle for you.

Overview

The contents in this material:

- Basics of Linux
- Bash-scripting
- Vim
- Man Pages

Basics of Linux

The Shell - **Bash**

The shell, or the terminal is a really useful tool. Bash is the standard shell on most Linux distros.

One really useful trick when working with bash is to search for old commands that you have used. You can access this search function by doing ctr-r in the terminal.

Basics of Linux

Navigating

pwd - Print working directory

cd - Change directory

cd   - Change directory to your home directory

cd - - Go back to previous directory

Basics of Linux

Looking at files

ls - List files in directory

ls -ltr - Sort list by last modified. -time -reverse

file - Show info about file. What type of file it is. If it is a binary or text file for example.

cat - Output content of file.

less - Output file but just little bit at a time. Use this one. Not more.

Use /searchterm to search. It is the same command as in vim. n to scroll to next search result. Press q to quit.

more - Output file but just little bit at a time. less is better.

Basics of Linux

Working with files

touch - Create a new file.

cp - Copy

mkdir - Make directory.

# Make entire directory structure

mkdir -p new/thisonetoo/and/this/one

rm - Remove file

# Remove recursively and its content. Very dangerous command!

rm -rf ./directory

Watch the command destroy an entire machine: https://www.youtube.com/watch?v=D4fzInlyYQo

rmdir - Remove empty directory

Basics of Linux

A little bit of everything

history - Show commands history

sudo

List what rights the sudo user has.

sudo -l

Sudo config file is usually /etc/sudoers

Basics of Linux

Finding files

There are mainly three ways to find files on Linux: find, locate, and which.

Find

Find is slower than locate but a lot more thorough. You can search for files recursively and with regex and a lot of other features.

```
# This will send all permissions denied outputs to dev/null.

find / -name file 2>/dev/null
```

Basics of Linux

Locate

Locate is really fast because it relies on an internal database. So in order to have it updated you need to run:

```
sudo updatedb
```

Then you can easily find stuff like this:

```
locate filename
```

Which

Outputs the path of the binary that you are looking for. It searches through the directories that are defined in your $PATH variable.

```
which bash
# Usually outputs: /bin/bash
```

Basics of Linux

Pipes

> : direct normal output.

2> : direct error output.

&> : direct all output.

Basics of Linux

Tar

Archiving utility

tar

-c : create archive

-t : list the content of the file

-x : extract the files

-j : bzip2 format

-z : gzip format

Basics of Linux

Editing text

First let’s just clear out something about standard streams, or I/O-streams. Standard streams are the streams that are used to interact between the human computer-user and the machine. There are three standard streams: standard input (stdin), standard output (stdout), and standard error (stderr).The stdin stream can be seen as an abstractions of the real keyboard input. So when you issue a command/program that requires input the program does not read straight from the keyboard input, instead it reads from the file STDIN.

Basics of Linux

Stdin

Stdin is the data that gets inputed into the program. An example of a program that requires stdin data is cp. In order for the program to do anything it needs input data. For example cp file1 copy_of_file1. Here file1 and copy_of_file1 is the stdin.

So the default Stdin comes from the STDIN-file that is a text-file representation of the keyboard input. But often times we do not want to input stuff from the keyboard, sometimes we want to input something into a program that comes from another file. That is when we can use redirection symbol: >.

So an example could be cat < my_text_file.txt. The data from my_text_file.txt will now be used as input instead of the keyboard input.

The file descriptor for stdin is: 0

Basics of Linux

Stdout

Stdout is the data that get ouputed from the program.

For example, when you use the command cat file1 that data/text that gets outputed is the stdout The same with the program ls. Not all programs have stdout. For example when you use mv or cp successfully you get no stdout back from the program.

The stdout can be redirected to another file by using these symbols > and ». So now we can do the following:

ls > result_of_ls.txt

# now the result will be written to the file result_of_ls.txt

ls » result_of_ls.txt

# This will append the data to the bottom of the file result_of_ls.txt

Basics of Linux

Another incredibly useful feature is the pipe feature, reprsented with this symbol |. It will take the stdout and redirect it into another program. Here is an example:

ls -la | less

This will take the stdout from ls -la and forward/redirect it into the less program. Using the pipe you can now chain different commands.

The file descriptor for stdout is: 1

Basics of Linux

Stderr

Stderr is the stream used for outputting error messages. So if a program fails for whatever reason. For example, if we try to copy a file that does not exist, this will be the stdrr output:

```
cp thisfiledoesnotexist aaaaaaaaaa
```

```
cp: cannot stat 'thisfiledoesnotexist': No such file or directory
```

This is a common way for stderr to present itself, just straight out into the terminal. But sometimes stderr gets sent to a log file.

Stderr is useful because with it we can separate between stdout and stderr. However, to the eye it might be difficult to distinguish what output is stdout and what output is stderr.

Basics of Linux

One easy way to determine is the output is stderr or stdout is to simply redirect it into a file. Because by default you only redirect stdout, and not stderr.

```
cp thisfiledoesnotexist aaaaaaaaaa > result.txt

cp: cannot stat 'thisfiledoesnotexist': No such file or directory

# If we now look at result.txt we will find that it is empty. Since the error-text we
recieved could not be redirected into the textfile, since it is stderr and not stdout.
```

Basics of Linux

Filters

There are certain programs that are especially useful to use together with pipes. They can also be used as stand-alone programs but you will often see them together with pipes.

```
sort

sort test.txt

uniq

sort -u test.txt

sort test.txt | uniq

cat filename | sort -u > newFileName

grep

head

tail

tr

sed
```

Basics of Linux

Editing text

sed

Can perform basic editing on streams, that is to say, text.

Remove first line of file/stream

```
sed "1d"
```

Basics of Linux

cut

Cut by column

This is a useful command to cut in text.

Let's say that we have the following text, and we want to cut out the ip-address.

```
64 bytes from 192.168.0.1: icmp_req=1 ttl=255 time=4.86 ms
```

```
cut -d" " -f4
```

-d stands for delimiter. and -f for field.

Basics of Linux

tr - **Translate**

Transform all letter into capital letters

```
tr "[:lower:]" "[:upper:]" < file1 > file2
```

Example

Remove character

```
# Remove characters
cat file.txt | tr -d "."
# Remove and replace
# Remove all dots and replace them with underscore.
cat file.txt | tr "." "_"
```

http://www.thegeekstuff.com/2012/12/linux-tr-command/

awk

So awk is an advanced tool for editing text-files. It is its own programming language to it can become quite complex. Awk iterates over the whole file line by line.

This is the basic structure of an awk command

awk '/search_pattern/ action_to_take_on_matches; another_action; ' file_to_parse

The search pattern takes regex.

You can exclude the search portion or the action portion.

This just prints every line of the file.

awk 'print' filename

Basics of Linux

Filtering out specific ip-address:

```
awk '/172.16.40.10.81/’ error.log
```

Now we want to print out the fourth column of that file, we can just pipe this to cut, but we can also use awk for it, like this:

```
awk '/172.16.40.10.81/ print $4’ error.log
```

```
# Another example
```

```
awk '{print $2,$5;}’ error.txt
```

This prints columns 2 and 5.

Basics of Linux

We can use the -F flag to add a custom delimiter.

```
awk -F ':' '{print $1}' test.txt
```

So if you are manipulating some text you might want to start the output with some info about the columns or something like that. To do that we can use the BEGIN-keyword.

```
awk 'BEGIN {printf "IP-address \tPort\n"} /nop/ {print $3}' test.txt | head
```

```
awk 'BEGIN{printf "IP-address \tPort\n"} /nop/ {print $3} END {printf "End of the
file\n"}' test.txt | tail
```

Here we are printing IP-address PORT to the first line of the file.

Basics of Linux

User management

To add a user we do:

```
adduser NameOfUser
# On some machines it is
useradd nameOfUser
```

To add user to sudo-group:

```
adduser NameOfUser sudo
```

On some machines we might not be able to edit the sudoers file because we don't have an interactive shell, in this case can you can just redirect the text into the file, like this:

```
echo "username ALL=(ALL) ALL" » /etc/sudoers
```

Basics of Linux

Check which users are in the sudo group:

```
cat /etc/group | grep sudo
```

Switch user in terminal:

```
su NameOfUser
```

Remove/delete user:

```
sudo userdel NameOfUser
```

Basics of Linux

Permissions

```
ls -la
```

Shows all the files and directories and their permission settings.

```
drwxrwxrwt 2 root root 4,0K ago 3 17:33 myfile
```

Here we have 10 letters in the beginning. The first one d shows that it is a directory.

The next three letters are for read, w for write and x for execute. The first three belong to the owner, the second three to the group, and the last three to all users.

https://linuxjourney.com/lesson/file-permissions

Basics of Linux

Example Setuid

```
-rwsr-xr-x user 0 Mar 6 10:45 myfile
```

Basics of Linux

Processes

To display information regarding the systems processes you can use the ps command.

ps -aux

-a stands for all

-u stands for all processes by all users

-x stands for all processes that don't run a tty

If you run this command you will probably see a pretty big output. In the column for command you will see what command has been run. Every process has a Process Identification Number (PID). Something you will also see in the output.

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All of theses processes can actually be found in /proc. You just go to /proc/[pid]. In /proc you can find information about the system, and you can actually change the system if you change those files! But more on that later. What I wanted to explain is that if we look at the output from ps we see that some commands are in brackets. Like this:

```
root 10 0.0 0.0 0 0 ? S ene14 0:00 [watchdog/0]

root 11 0.0 0.0 0 0 ? S ene14 0:00 [watchdog/1]

root 12 0.0 0.0 0 0 ? S ene14 0:00 [migration/1]

root 13 0.0 0.0 0 0 ? S ene14 0:00 [ksoftirqd/1]
```

Those are usually kernel processes, and you can safely assume that no user has started them.

If you want to monitor processes in real time you can use top or htop. top comes preinstalled on most distros. But htop is really a lot nicer.

Basics of Linux

For htop the F1-10 keys might trigger OS-events. So you can use the shortcuts instead.

Shortcut Key	Function Key	Description
h	F1	Invoke htop Help
S	F2	Htop Setup Menu
/	F3	Search for a Process
I	F4	Invert Sort Order
t	F5	Tree View
>	F6	Sort by a column
[	F7	Nice – (change priority)
]	F8	Nice + (change priority)
k	F9	Kill a Process
q	F10	Quit htop

http://www.thegeekstuff.com/2011/09/linux-htop-examples/

Packages

Something that difference Linux from windows is how it handles installing new software. In windows you usually have to google around and then click on random scary download buttons that might fuck up your computer, or not. It's like a constant lottery where you win by no installing malware. In Linux that is usually not really an issue. That is because distros have their own software repositories from where you can download your software. This is kind of like an app-store except everything is free.

The different major branches of teh GNU/Linux OS have their own software repositories. Ubuntu has their own, debian has their own, and so on.

Different distros also have their own package-amangers. For example, Debian and ubuntu uses apt, while Redhat uses rpm, and Arch uses pacman. You should strick to your own package-manager, because even though chaning package-manager is possible it will probably just cause you more headache than benefits.

Basics of Linux

Install package

Example of how to install something with apt:

```
sudo apt-get install nmap
```

If you only have a .deb file you do this to install from the terminal:

```
sudo dpkg -i /path/to/deb/file
sudo apt-get install -f
```

Basics of Linux

Remove packages

This can be tricky. First find the package

```
dpkg –list
```

Then you find it in your list.

```
sudo apt-get –purge remove nameOfProgram
```

When you remove some package it might have requires some other dependencies. To remove those you run

```
sudo apt-get autoremove
```

Basics of Linux

Quick package notes

dpkg -i <Package>.deb - Install package.

dpkg -r <Package> - Removes everything except configuration files.

dpkg -P <Package> - Removes configurations files too.

dpkg -l - Shows the list of all installed packages.

dpkg -L "Package name" - Shows a list of files installed by specific packages.

dpkg -S "File path" - Shows the package to which a file belong to.

Basics of Linux

Organizing your $path variable

I am talking about debian/ubuntu here. On other systems I don't know.

You can define your path in /etc/environment. If you don't have it you can create it and add the path like this:

```
source /etc/environment && export PATH
```

If you are using zsh (which you should) you have to add it here

```
sudo vim /etc/zsh/zshenv
```

And add this line somewhere:

```
source /etc/environment
```

Basics of Linux

Adding a path

This is a non-persistent way to add binaries to your path. Might be useful if you have entered a system that has limited binaries in the path.

```
export PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
```

Basics of Linux

Installing custom packages

If you download a package that is not in the official repository you can put the binary in /opt. That is good place to put your binaries.

Now you need to add that path to your path-variable. Remember how we set that in /etc/environment. So now open up that file and add /opt to it, so i looks like this.

```
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:
/sbin:/bin:/usr/games:/usr/local/games:/opt"
```

I always add custom binaries last. That means that if we have two binaries with the same name the machine will first select the original binary. This way you won't have to fear screwing up, by accidentally creating a new ls binary for example.

Basics of Linux

Cronjobs

There are two ways to configure cronjobs. The first one is by putting scripts in the following folders.

/etc/cron.daily

/etc/cron.hourly

/etc/cron.weekly

/etc/cron.monthly

The second way is to write the command in the crontab

```
# list cronjobs

crontab -l

# Edit or create new cronjobs

crontab -e
```

Basics of Linux

Devices

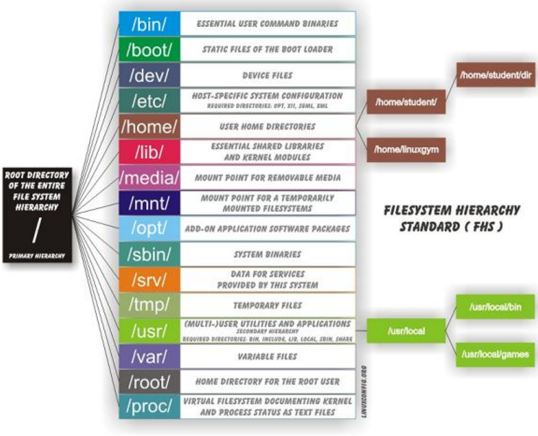
List all devices

```
fdisk -l
```

Basics of Linux

The Filesystem

The Filesystem Hierarchy Standard



/bin/	ESSENTIAL USER COMMAND BINARIES
/boot/	STATIC FILES OF THE BOOT LOADER
/dev/	DEVICE FILES
/etc/	HOST-SPECIFIC SYSTEM CONFIGURATION REQUIRED DIRECTORIES: OPT, X11, SGML, XML
/home/	USER HOME DIRECTORIES
/lib/	ESSENTIAL SHARED LIBRARIES AND KERNEL MODULES
/media/	MOUNT POINT FOR REMOVABLE MEDIA
/mnt/	MOUNT POINT FOR A TEMPORARILY MOUNTED FILESYSTEMS
/opt/	ADD-ON APPLICATION SOFTWARE PACKAGES
/sbin/	SYSTEM BINARIES
/srv/	DATA FOR SERVICES PROVIDED BY THIS SYSTEM
/tmp/	TEMPORARY FILES
/usr/	(MULTI-)USER UTILITIES AND APPLICATIONS SECONDARY HIERARCHY REQUIRED DIRECTORIES: BIN, INCLUDE, LIB, LOCAL, SBIN, SHARE
/var/	VARIABLE FILES
/root/	HOME DIRECTORY FOR THE ROOT USER
/proc/	VIRTUAL FILESYSTEM DOCUMENTING KERNEL AND PROCESS STATUS AS TEXT FILES

This image is copied from here: http://askubuntu.com/questions/138547/how-to-understand-the-ubuntu-file-system-layout/138551#138551

Basics of Linux

Difference between sbin and bin

sbin is system binaries. A normal user do not have access to these binaries. It is only root and users with sudo privileges that do.

```
pellemymachine:/bin$ ls -la /bin

total 4092

drwxr-xr-x 2 root root 4096 2012-02-04 19:12 .

drwxr-xr-x 21 root root 4096 2012-02-06 18:41 ..

–snip–

-rwxr-xr-x 1 root root 40560 2008-02-29 02:19 ed

-rwxr-xr-x 1 root root 96440 2007-10-23 16:58 egrep

-rwxr-xr-x 1 root root 22192 2008-04-04 02:42 false

-rwxr-xr-x 1 root root 5740 2008-02-06 17:49 fgconsole

-rwxr-xr-x 1 root root 53396 2007-10-23 16:58 fgrep

-rwxr-xr-x 1 root root 8796 2007-11-15 13:01 hostname
```

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We have echo, cp, grep. The normal stuff a user needs.

In sbin we have binaries that control the system.

```
ls -la /sbin
total 5884
drwxr-xr-x 2 root root 4096 2012-02-04 10:01 .
drwxr-xr-x 21 root root 4096 2012-02-06 18:41 ..
-rwxr-xr-x 3 root root 23840 2008-03-27 13:25 findfs
-rwxr-xr-x 1 root root 20020 2008-03-27 13:25 fsck
-rwxr-xr-x 1 root root 15168 2008-09-26 08:43 getty
-rwxr-xr-x 1 root root 375 2009-12-10 10:55 grub-install
lrwxrwxrwx 1 root root 6 2012-02-04 09:51 halt -> reboot
-rwxr-xr-x 1 root root 69228 2008-03-28 18:26 hdparm
-rwxr-xr-x 1 root root 31620 2008-09-26 08:43 hwclock
-rwxr-xr-x 1 root root 61808 2007-12-13 05:51 ifconfig
-rwxr-xr-x 2 root root 27372 2007-09-19 20:25 ifdown
```

Mount

So everything on the linux-filesystem belongs to some part of the filesystem-tree. So if we plug in some device we need to mount it to the filesystem. That pretty much means that we need to connect it to the filesystem. Mount is like another word for connect.

So if you want to connect a CD-rom or USB to your machine. You need to mount it to a specific path on the filesystem.

So if you plug in the usb it might be accessible at /dev/usb. But that it not enough for you to be able to browse the usb content. You need to mount it. You do this by writing

mount /dev/usb /media/usb

Or whereever you want to mount it.

So when you click on Eject or Safetly remove you are just unmounting.

umount /media/usb

Knowing how to mount and unmount might be useful if you want to get access to a remote NFS-directory. You will need to mount it to your filesystem to be able to browse it.

Basics of Linux

Controlling services

Systemctl

Systemctl can be used to enable and disable various services on your linux machine.

Start ssh

```
systemctl start ssh
```

```
systemctl status ssh
```

```
systemctl stop ssh
```

You can verify that the service is listening for connection by running network status.

```
netstat -apnt
```

Make ssh start upon boot

```
systemctl enable ssh
```

```
systemctl enable apache2
```

Basics of Linux

Init.d

Init.d is just a wrapper around Systemctl. I prefer it.

/etc/init.d/cron status

/etc/init.d/cron start

/etc/init.d/cron stop

rcconf

This is a tool to control services more easily, what is running upon boot and so on.

Basics of Linux

Kernel

The Kernel is responsible for talking between the hardware and the software, and to manage the systems resources.

The Linux Kernel is a monolithic kernel, unlike the OSX and the Windows kernels which are hybrid.

You can find the kernel file in /boot. It might look like something like thisvmlinuz-4.4.0-57-generic. In the beginning of time the kernel was simply called linux. But when Virtual Memory was introduced they changed the name to vmlinux to reflect that the kernel could handle virtual memory. When the kernel later became too big it was compressed using zlib , therefore the name was changed to vmlinuz.

The Linux Kernel differs from Windows in that it contains drivers by default. So you don't have to go around looking for drivers like you do on windows when you want to install a printer, or something like that.

It is really easy to upgrade to the latest Linux kernel, all you have to do tis this:

```
sudo apt-get update && sudo apt-get dist-upgrade
```

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or

sudo apt-get update && sudo apt-get upgrade

If you are using a distro that is Long Term Supported (LTS). You will not get the latest Kernel version, but you will get the latest Long Term Supported version.

Logging

Logs can be viewed here on debian distros /var/log/

Basics of Linux

Network basics

Netstat - Find outgoing and incoming connections

Netstat is a multiplatform tool. So it works on both mac, windows and linux.

```
$ netstat -antlp
Proto Recv-Q Send-Q Local Address Foreign Address State PID/Program name
tcp 0 0 mymachine:domain *:* LISTEN -
tcp 0 0 localhost:ipp *:* LISTEN -
tcp 0 0 localhost:27017 *:* LISTEN -
tcp 0 0 localhost:mysql *:* LISTEN -
tcp 0 0 192.168.0.15:44013 ec2-54-85-27-14.c:https ESTABLISHED 6604/slack –disabl
tcp 0 0 192.168.0.15:51448 ec2-50-16-193-3.c:https ESTABLISHED 3120/chrome
tcp 0 0 192.168.0.15:43476 104.27.152.203:https TIME_WAIT -
tcp 0 0 192.168.0.15:59380 149.154.175.50:https ESTABLISHED 5068/Telegram
tcp 0 0 192.168.0.15:53840 149.154.175.50:http ESTABLISHED 5068/Telegram
```

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A few interesting things to observe here is that my machine is using any port over 1024 to connect to the outside. So it is not like just because we communicate with https and connect to port 443 that we use that port on our machine. On our machine it can be any port (over 1024) and usually any port over 10000.

Find out what services are listening for connection on your machine

Flags

-a # All

-n # show numeric addresses

-p # show port

-t # tcp

netstat -anpt

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To easily check out what process is using lots of bandwidth you can use nethogs.

sudo apt-get install nethogs

nethogs

Or you can use tcpdump, or iptables.

Every listening process of course has a PID, but unless you are root you can't might not see them all.

Firewall - Iptables

Iptables is a firewall tool in linux. A firewall is basically a tool that scans incoming and/or outgoing traffic. You can add rules to the iptables to filter for certain traffic.

Types of chains

So you can filter traffic in three different ways input, forward, and output. These are called three different chains.

INPUT

This is for incoming connections. If someone wants to ssh into your machine. Or a web-server responds to your request.

FORWARD

This chain is used for traffic that is not aimed at your machine. A router for example usually just passes information on. Most connections are just passing through. As you can see this will probably not be used so much on your machine, as a normal desktop or a server doesn't router that much traffic.

Basics of Linux

OUTPUT

This chain is used for outgoing traffic.

Active rules

To view your active rules you do

iptables -L

# It will output something like this

Chain INPUT (policy ACCEPT)

target prot opt source destination

Chain FORWARD (policy ACCEPT)

target prot opt source destination

Chain OUTPUT (policy ACCEPT)

target prot opt source destination

Basics of Linux

So as we can see the current policy is to accept all traffic in all directions.

If you for some reason has been tampering with the iptables and maybe fucked up. This is how you return it to the default setting, accepting all connections

```
iptables –policy INPUT ACCEPT
```

```
iptables –policy OUTPUT ACCEPT
```

```
iptables –policy FORWARD ACCEPT
```

If you instead want to forbid all traffic you do

```
iptables –policy INPUT DROP
```

```
iptables –policy OUTPUT DROP
```

```
iptables –policy FORWARD DROP
```

Basics of Linux

Okay, so let's block out some connections. To do that we want to add/append a new rule. We want to block all connections from our enemy 192.168.1.30.

```
# A for append, and S for source.
```

```
iptables -A INPUT -s 192.168.1.30 -j DROP
```

```
# Block an entire range
```

```
iptables -A INPUT -s 192.168.1.0/24 -j DROP
```

Now if we want to see our current rules we just do

```
iptables -L
```

And we can now see our new rule.

To add line-numbers for each rule, so that you can then specify which rule you want to reset or change or something you can output the rluels with line-numbers

```
iptables -L -v –line-numbers
```

Remove/delete a rule

To remove a rule you just do

# Remove one specific rule

iptables -D INPUT 2

# Remove all rules

iptables -F

Save your changes

Your changes will only be saved and therefore in action until you restart iptables. So they will disappear every time you reboot unless you save the changes. To save the changes on ubuntu you do

sudo /sbin/iptables-save

Basics of Linux

Measuring bandwidth usage

There are a few different tools in hour arsenal that we can use to measure bandwidth usage. We will start with iptables.

To view the input and output traffic we just list the rules with some verbosity.

```
iptables -L -v
```

```
# Stdout
Chain INPUT (policy ACCEPT 6382 packets, 1900K bytes)
pkts bytes target prot opt in out source destination
Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
pkts bytes target prot opt in out source destination
Chain OUTPUT (policy ACCEPT 4266 packets, 578K bytes)
pkts bytes target prot opt in out source destination
```

Basics of Linux

So clean this up and reset the count we can do the following

```
# Restar the count
iptables -Z
# Remove all the rules, FLUSH them
iptables -F
```

So now we just need to add our rules. A simple script for this would be

```
#!/bin/bash
iptables -F
iptables -I INPUT 1 -p tcp -j ACCEPT
```

Then check out the traffc with

```
iptables -L -v –line-numbers
```

Basics of Linux

Examples

Block outgoing connections to a specific ip

```
iptables -A OUTPUT -d 198.23.253.22 -j DROP
```

https://www.digitalocean.com/community/tutorials/how-to-list-and-delete-iptables-firewall-rules

Troubleshooting

Have you tried turning it on and off?

I have had problems with the network-adapter not starting or something like that, on Ubuntu. You can try to restart the network manager if this happens:

```
sudo service network-manager restart
```

Basics of Linux

Magical rfkill

If for some reason the wifi is blocked you can unblock it (or block it) with rfkill.

```
$ rfkill list

0: phy0: Wireless LAN

Soft blocked: no

Hard blocked: no

2: hci0: Bluetooth

Soft blocked: no

Hard blocked: no
```

Basics of Linux

To block or unblock the phy0 from the example above you do:

```
# Block
rfkill block 0
# Unblock
rfkill unblock 0
```

If there is a hard block it means that there is a physical switch on you machine that you need to switch off.

Basics of Linux

Keyboard Shortcuts

Ctrl + a : Move to the start of line.

Ctrl + e : Move to the end of line.

Ctrl + w : Cut from cursor to previous whitespace.

Ctrl + k : Cut from cursor to the end of line.

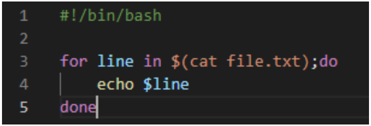
Ctrl + y : Paste the last cut text.

Bash-scripting

Bash-scripting

Iterate over a file

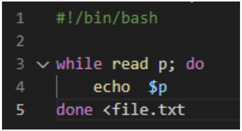
This script will iterate over a file and echo out every single line:



```
#!/bin/bash

for line in $(cat file.txt);do
    echo $line
done
```

Bash-scripting

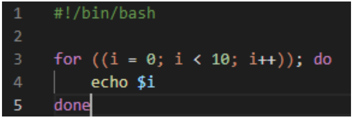
Another way of writing is this:



```
#!/bin/bash

while read p; do
    echo  $p
done <file.txt
```

Bash-scripting

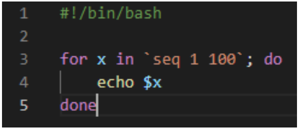
For-loops



```
#!/bin/bash

for ((i = 0; i < 10; i++)); do
    echo $i
done
```

Bash-scripting

Another way to write this is by using the program seq. Seq is pretty much like range() in python. So it can be used like this:

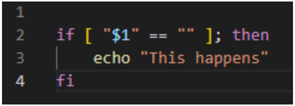


```
#!/bin/bash

for x in `seq 1 100`; do
    echo $x
done
```

Bash-scripting

If statement

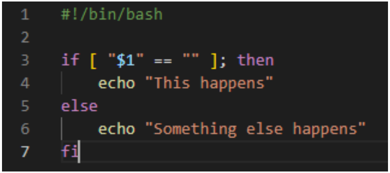
$1 here represent the first argument.



```bash

if [ "$1" == "" ]; then
    echo "This happens"
fi
```

Bash-scripting

If/Else

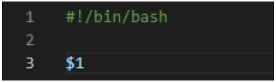


```bash
#!/bin/bash

if [ "$1" == "" ]; then
    echo "This happens"
else
    echo "Something else happens"
fi
```

Bash-scripting

Command line arguments

Command line arguments are represented like this



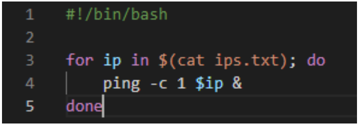
```
#!/bin/bash

$1
```

This is the first command line argument.

Bash-scripting

Daemonize an execution

If you do a ping-sweep with host the command will take about a second to complete. And if you run that against 255 hosts I will take a long time to complete. To avoid this we can just deamonize every execution to make it faster. We use the & to daemonize it.



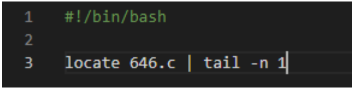
```bash
#!/bin/bash

for ip in $(cat ips.txt); do
    ping -c 1 $ip &
done
```

Bash-scripting

Use the output of command

It has happened to me several times that I want to input the output of a command into a new command, for example:

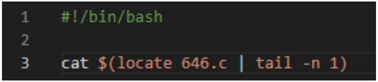
I search for a file, find three, and take the last line, which is a path. Now I want to cat that path:



```
#!/bin/bash

locate 646.c | tail -n 1
```

Bash-scripting

This can be done like this:



```
#!/bin/bash

cat $(locate 646.c | tail -n 1)
```

Vim

Vim

http://www.viemu.com/a-why-vi-vim.html

And also this classic answer: https://stackoverflow.com/questions/1218390/what-is-your-most-productive-shortcut-with-vim

Vim

Core concepts

In vim you have the concept of buffers.

```
# List buffers
:buffers
# Switch buffer
# By number
b1
b2
# By name
b [name]
# Close/delete a buffer
:bdelete
:bd
```

Vim

Movement - Motion commands

Left,up,down,right

hjkl

start of line

0 (zero)

end of line

$

beginning of next word

w

beginning of next word, defined by white space

W

end of the next word

e

Vim

end of the next word, defined by white space

E

back to the beginning of previous word

b

back to the end of previous word

B

go to next character of your choice

If you want to go to the next comma

f,

start of file

gg

end of file

G

Vim

Additional Commands

:q - Quit.

:wq - Save and close.

:syntax on - Turn on Syntax highlighting for C programming and other languages.

:history - Shows the history of the commands executed

:set number - Turn on the line numbers.

:set nonumber - Turn off the line numbers.

Vim

Operators

Operators are commands that do things. Like delete, change or copy.

c - change

ce - change until end of the word.

c$ - change until end of line.

Vim

Combining Motions and Operators

Now that you know some motion commands and operator commands. You can start combining them.

dw - delete word

d$ - delete to the end of the line

Vim

Count - **Numbers**

You can add numbers before motion commands. To move faster.

4w - move cursor three words forward

0 - move curso to the start of the line

You can use numbers to perform operations.

d3w - delete three words

3dd - delete three lines

Vim

Replace

If you need to replace a character, there is no need to enter insert-mode. You can just use replace

Go to a character and the press r followed by the character you want instead.

rp if you want to replace p.

R

Vim

Clipboard

In order to copy something FROM vim to the OS-clipboard you can do this:

The " means that we are not entering a registry. And the * means the OS-clipboard. So we are yanking something and putting it in the OS-clipboard registry.

```
"*y
```

Vim

Substitute - **Search and replace**

:s/thee/the/g

Entering insert-mode

i - current character

o - next line

O - line before

a - end of word

A - end of line

Vim

.vimrc

Here is all your vim-configuration.

Contains optional runtime configuration settings to initialize Vim when it starts. Example: If you want Vim to have syntax on and line numbers on, whenever you open vi, enter syntax on and set number in this file.

##Sample contents of .vimrc

```
syntax on

set number
```

Vim

Plugins

Install vundle here

https://github.com/VundleVim/Vundle.vim

Add plugin

Add plugin to your .vimrc-file and then open vim and write

:PluginInstall

Man pages

Man pages

Online man pages are available at https://man.cx/ if you are curious about some flags and not near a linux terminal