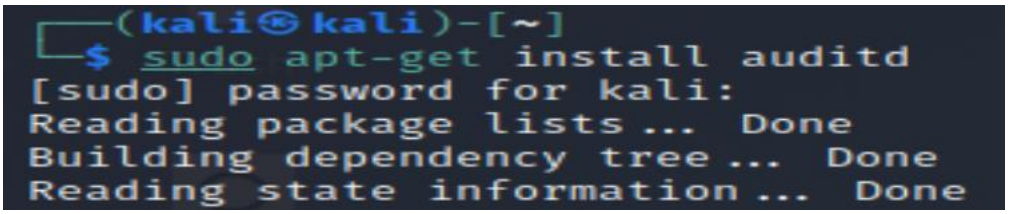
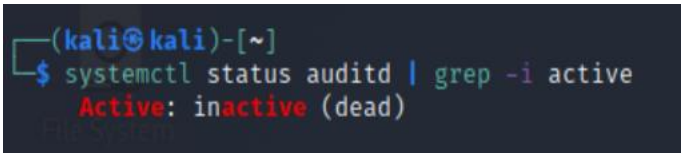
Report 11

For this week's lab focused on part 2 of Linux forensics using the Linux audit system. The first task involved using the Linux Auditing System by utilizing the (auditd) package. The next task involved Security Auditing using the package called Lynis.

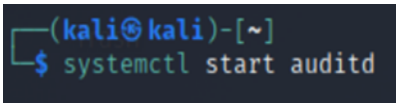
For the first task, we needed to install the Linux audit system **auditd**. This is a component that is added to the audit component Linux Audit System This utility is responsible for writing audit records to the disk. Viewing the logs is done with the **ausearch** or **aureport** utilities. Configuring the audit system or loading rules is done with the **auditctl** utility. To begin install the auditd utility, use **sudo apt-get install auditd** command. Here below is the output.



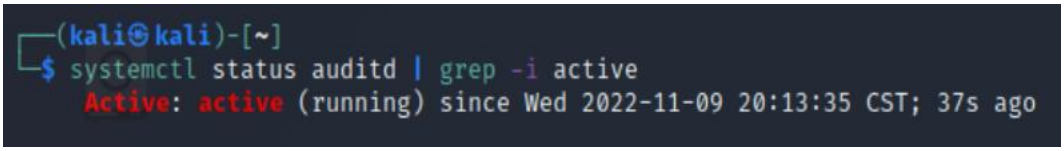
Once installed, we need to display the status **auditd.** To display the status use **systemctl status auditd | grep -i active.** Note the that the status shows as inactive.



Since it is inactive, we need to start the service. To do that, use **systemctl start auditd** command. Here below is the output. Note that no output was shown.



Now, if we want to verify the status of **auditd**, we need to use the previous command **systemctl status auditd | grep -i active** that we used to check the status of **auditd.** Here below is the output. Note that the status now is active and its running. You also see the time and date the status has been active.



The Linux Auditing System is a native auditing system to Linux kernel. Some of these components include the **auditctl** which controls the behavior of the daemon, adds rules etc. The **/etc/audit/audit.rules** file contains the rules and various parameters of the auditd daemon.

The component **aureport** generate report of the activity on a system. The component **ausearch** searches for various events. **auditspd** which can be used to relay event notifications to other applications instead of writing them to disk in the audit log. The **autrace** command can be used to trace a process, much like **strace**. These audit daemon configurations are options that system admins can choose to customize. These are controlled in the **/etc/audit/auditd.conf** file
You can list the contents of the audit folder using **sudo ls -l /etc/audit/** command. Here below is the output.

```
┌──(kali㉿kali)-[~]
└─$ sudo ls -l /etc/audit/
total 20
-rw-r----- 1 root root  881 Mar 13  2022 auditd.conf
-rw-r----- 1 root root  107 Nov  3 19:15 audit.rules
-rw-r----- 1 root root  127 Mar 13  2022 audit-stop.rules
drwxr-x--- 2 root root 4096 Nov  9 20:08 plugins.d
drwxr-x--- 2 root root 4096 Nov  9 20:08 rules.d
```

To view the details of the file configurations of the audit daemon, use the command **sudo cat /etc/audit/auditd. conf | head.** Here below is the output. You see some of option that are enabled such as the local events and writing logs.

```
┌──(kali㉿kali)-[~]
└─$ sudo cat /etc/audit/auditd.conf | head
#
# This file controls the configuration of the audit daemon
#

local_events = yes
write_logs = yes
log_file = /var/log/audit/audit.log
log_group = adm
log_format = ENRICHED
flush = INCREMENTAL_ASYNC
```

The **auditctl** can be used to control the audit system. You can view the query status of the audit daemon by using the command **sudo auditctl -s.** Here below is the output.

```
┌──(kali㉿kali)-[~]
└─$ sudo auditctl -s
enabled 1
failure 1
pid 4171
rate_limit 0
backlog_limit 8192
lost 0
backlog 0
backlog_wait_time 60000
backlog_wait_time_actual 0
loginuid_immutable 0 unlocked
```

Note that depending on the flag determines the meaning and possible values. For example, for **enabled** there are 3 options. These are 0 – disabled, 1 - enable, and 2 – enable and lock down the configuration. The **pid** is the process Id of **auditd**. The failure flag specifies how the kernel will handle critical errors. These options include 0 – Silent, 1 – printk, and 2 – panic. The lost flag refers to the amount of lost audit messages.

Now to enable the audit system, use **sudo auditctl -e 1** command. Note that there is no output. If you want to view audit events use the command **sudo cat /var/log/audit/audit.log | grep -I**

syscall | head -n 1. You can choose the number of events you want to display by changing the number. Here below is the output only displaying one. Note that the type of event shown is a system call (SYSCALL). You can use this to determine the type of events that occur and what causet them to trigger them.

```
┌──(kali㉿kali)-[~]
└─$ sudo cat /var/log/audit/audit.log | grep -i syscall | head -n 1
type=SYSCALL msg=audit(1667521852.069:4): arch=c000003e syscall=44 success=yes exit=60 a0=3 a1=7ffdd3c6f450 a2=3c a3
=0 items=0 ppid=6225 pid=6235 auid=4294967295 uid=0 gid=0 euid=0 suid=0 fsuid=0 egid=0 sgid=0 fsgid=0 tty=(none) ses
=4294967295 comm="auditctl" exe="/usr/sbin/auditctl" subj=unconfined key=(null)ARCH=x86_64 SYSCALL=sendto AUID="uns
et" UID="root" GID="root" EUID="root" SUID="root" FSUID="root" EGID="root" SGID="root" FSGID="root"
```

The **aureport** utility is responsible for producing summary reports of the audit system logs. These reports are stored in the **/var/log/audit/audit.log** file. You can view the reports by using the command **sudo aureport -if /var/log/audit/audit.log.** You can see below the details of the report. These include the number of users, logins, and changes in configuration.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport -if /var/log/audit/audit.log

Summary Report
======================
Range of time in logs: 11/03/2022 19:30:52.008 - 11/09/2022 20:27:04.762
Selected time for report: 11/03/2022 19:30:52 - 11/09/2022 20:27:04.762
Number of changes in configuration: 14
Number of changes to accounts, groups, or roles: 0
Number of logins: 0
Number of failed logins: 0
Number of authentications: 1
Number of failed authentications: 1
Number of users: 4
Number of terminals: 8
Number of host names: 1
Number of executables: 9
Number of commands: 7
Number of files: 22
Number of AVC's: 0
Number of MAC events: 0
Number of failed syscalls: 10
Number of anomaly events: 1
Number of responses to anomaly events: 0
Number of crypto events: 0
Number of integrity events: 0
Number of virt events: 0
Number of keys: 0
Number of process IDs: 81
Number of events: 586
```

The **aureport** utility can also display authentication attempts. You can view this by using the **aureport -au** command. Note the details of the attempts and as well as how many where made.

```
┌──(kali㉿kali)-[~]
└─$ aureport -au
Error opening config file (Permission denied)
NOTE - using built-in logs: /var/log/audit/audit.log

Authentication Report
============================================
# date time acct host term exe success event
============================================
1. 11/03/2022 19:58:29 root ? /dev/pts/0 /usr/bin/su no 99
2. 11/03/2022 20:26:46 root ? /dev/pts/1 /usr/bin/su yes 432
```

Viewing the logins attempts is also great to know. To view this, use the **sudo aureport -l** command. Note that there were no logins attempts on my system.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport -l

Login Report
============================================
# date time auid host term exe success event
============================================
<no events of interest were found>
```

Now to view attempts that were not successful, use the command **sudo aureport –failed.** You can see below the amount failed authentications attempts on my system.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport --failed

Failed Summary Report
======================
Range of time in logs: 11/03/2022 19:30:52.008 - 11/09/2022 20:31:52.689
Selected time for report: 11/03/2022 19:30:52 - 11/09/2022 20:31:52.689
Number of changes in configuration: 0
Number of changes to accounts, groups, or roles: 0
Number of logins: 0
Number of failed logins: 0
Number of authentications: 0
Number of failed authentications: 1
Number of users: 2
Number of terminals: 3
Number of host names: 1
Number of executables: 3
Number of commands: 2
Number of files: 8
Number of AVC's: 0
Number of MAC events: 0
Number of failed syscalls: 10
Number of anomaly events: 0
Number of responses to anomaly events: 0
Number of crypto events: 0
Number of integrity events: 0
Number of virt events: 0
Number of keys: 0
Number of process IDs: 3
Number of events: 12
```

To view the attempts that were successful, use **sudo aureport –success** command. Here below is the output.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport --success

Success Summary Report
======================
Range of time in logs: 11/03/2022 19:30:52.008 - 11/09/2022 20:32:38.272
Selected time for report: 11/03/2022 19:30:52 - 11/09/2022 20:32:38.272
Number of changes in configuration: 14
Number of changes to accounts, groups, or roles: 0
Number of logins: 0
Number of failed logins: 0
Number of authentications: 1
Number of failed authentications: 0
Number of users: 4
Number of terminals: 8
Number of host names: 1
Number of executables: 9
Number of commands: 7
Number of files: 14
Number of AVC's: 0
Number of MAC events: 0
Number of failed syscalls: 0
Number of anomaly events: 1
Number of responses to anomaly events: 0
Number of crypto events: 0
Number of integrity events: 0
Number of virt events: 0
Number of keys: 0
Number of process IDs: 83
Number of events: 561
```

You can also modify the start and end date for you audit report. To do this, **use sudo aureport -ts yesterday -te now --success**. You can specify the **yesterday** and **now** parameters to your choosing. Here below is a summary report of 11-08-2022 to 11-09-22. This is important to know to so that you can view certain days that you want.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport -ts yesterday -te now --success

Success Summary Report
======================
Range of time in logs: 11/03/2022 19:30:52.008 - 11/09/2022 20:33:51.897
Selected time for report: 11/08/2022 00:00:00 - 11/09/2022 20:33:51
Number of changes in configuration: 3
Number of changes to accounts, groups, or roles: 0
Number of logins: 0
Number of failed logins: 0
Number of authentications: 0
Number of failed authentications: 0
Number of users: 3
Number of terminals: 5
Number of host names: 1
Number of executables: 4
Number of commands: 3
Number of files: 0
Number of AVC's: 0
Number of MAC events: 0
Number of failed syscalls: 0
Number of anomaly events: 0
Number of responses to anomaly events: 0
Number of crypto events: 0
Number of integrity events: 0
Number of virt events: 0
Number of keys: 0
Number of process IDs: 19
Number of events: 104
```

If you want to view the user report, use **sudo aureport -u –summary.**

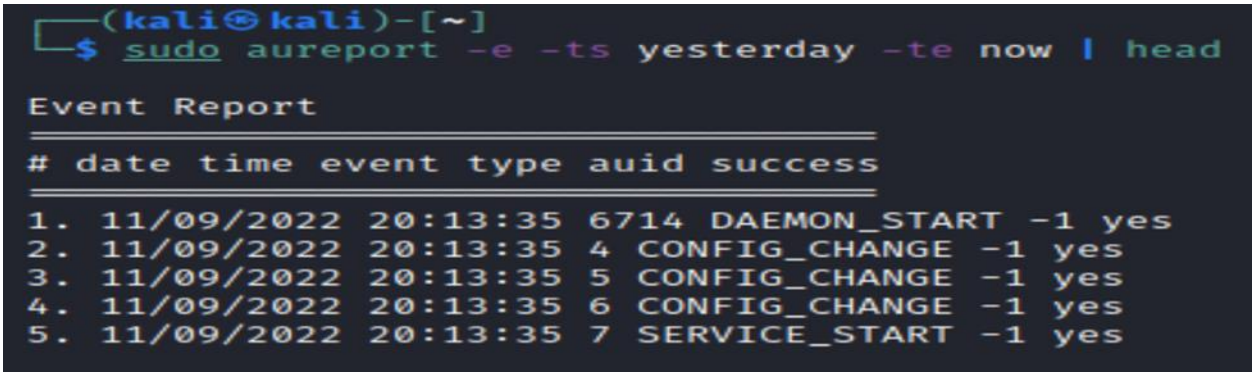
```
┌──(kali㉿kali)-[~]
└─$ sudo aureport -u --summary

User Summary Report
===================
total  auid
===================
430  1000
90  0
70  -1
3  130
```

The **auid** mentions the user. For example, 1000 is typically reserved for the use. 0 is reserved for the root. Total refers to the amount of audit reports that each user has.

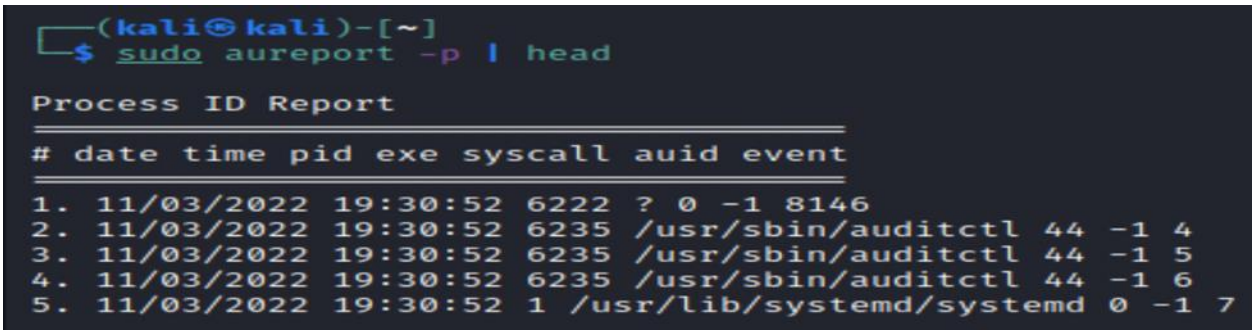
You can view a user summary in detail by using **sudo aureport -e -i –summary.** Here you see some events that were performed. Such a system call and a login.

```
┌──(kali㉿kali)-[~]
└─$ sudo aureport -e -i --summary

Event Summary Report
====================
total   type
====================
125   SYSCALL
74   USER_START
73   USER_ACCT
71   CRED_DISP
71   USER_END
53   CRED_REFR
53   USER_CMD
30   BPF
21   CRED_ACQ
19   LOGIN
14   CONFIG_CHANGE
11   SERVICE_START
9   SERVICE_STOP
2   USER_AUTH
2   DAEMON_START
1   ANOM_ABEND
```

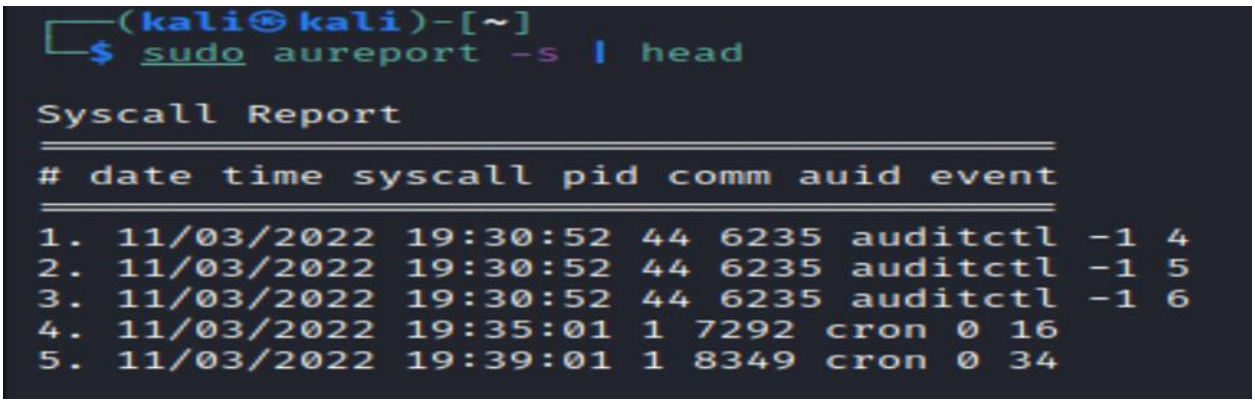
There are times when you to display the events such as the system call and the daemon started in a formatted way. To do this, you can use **sudo aureport -e -ts yesterday -te now | head.** Below, we specify the event that happened yesterday. Note some of the parameters that are shown such as the date, time and if they were successful.



Now, if you are looking for a process report, use **sudo aureport -p | head.** The report below shows the pid number as well as the exe file that was used. You also see the events and systems call there as well.



You can view the system call events in detail by using **sudo aureport -s | head** command. Here below are the system events, Syscall.



The **id** command will the identification number of the current user. Here you can see the uid that we saw earlier to view the user report. The number 1000 refers to the user. Which in this case is the user named kali. Here you also see other ids and their associated number as well.

```
┌──(kali㉿kali)-[~]
└─$ id
uid=1000(kali) gid=1000(kali) groups=1000(kali),4(adm),20(dialout),24(cdrom),25(floppy),27(sudo),29(audio),30(dip),4
4(video),46(plugdev),109(netdev),119(wireshark),122(bluetooth),134(scanner),143(kaboxer)
```

Now that we know which **id** belongs to user, you can expand your search by searching for events by a particular user. Here below are some of the events that occurred for this user. If you want to search for events miniated by a given user, you need tom specify the user id and then use **ausearch** to do this. To do this use **ausearch -ui 1000 | head** command.

```
┌──(kali㉿kali)-[~]
└─$ sudo ausearch -ui 1000 | head
----
time->Thu Nov  3 19:33:17 2022
type=USER_ACCT msg=audit(1667521997.970:8): pid=6872 uid=1000 auid=1000 ses=2 subj==unconfined msg='op=PAM:accountin
g grantors=pam_permit acct="kali" exe="/usr/bin/sudo" hostname=? addr=? terminal=/dev/pts/0 res=success'
----
time->Thu Nov  3 19:33:17 2022
type=USER_CMD msg=audit(1667521997.970:9): pid=6872 uid=1000 auid=1000 ses=2 subj==unconfined msg='cwd="/home/kali"
cmd=6C73202D6C202F6574632F617564469742F exe="/usr/bin/sudo" terminal=pts/0 res=success'
----
time->Thu Nov  3 19:33:17 2022
type=CRED_REFR msg=audit(1667521997.970:10): pid=6872 uid=1000 auid=1000 ses=2 subj==unconfined msg='op=PAM:setcred
grantors=pam_permit acct="root" exe="/usr/bin/sudo" hostname=? addr=? terminal=/dev/pts/0 res=success'
----
```

When you use autrace to trace audit processe, it important to delete any aundit rules that are in quueue to avoid conflict with autrace adds. To the delete the audit rules so that this problem does not occur, use **auditctl -D** command. Note that by default there are no rules.

```
┌──(kali㉿kali)-[~]
└─$ sudo auditctl -D
No rules
```

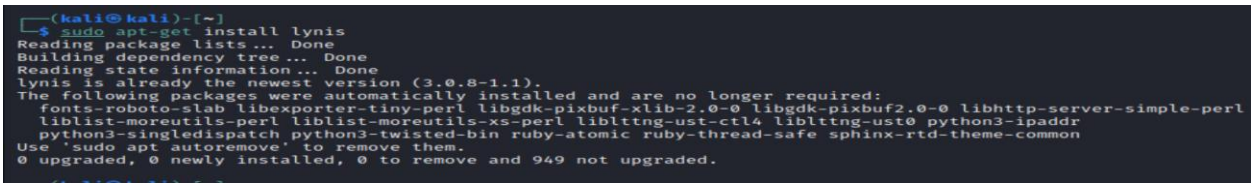
Here below is an example tracing the **/usr/bin/less** file. The command that to do this is **sudo autrace /usr/bin/less.** Note now you can locate the record now with the command below.

```
┌──(kali㉿kali)-[~]
└─$ sudo autrace /usr/bin/less
Waiting to execute: /usr/bin/less
Missing filename ("less --help" for help)
Cleaning up...
Trace complete. You can locate the records with 'ausearch -i -p 15045'
```

Now when you enter **sudo ausearch -i -p 15045** command into the terminal, you can see below the output. Note the events displayed in relation to the **/less** file.

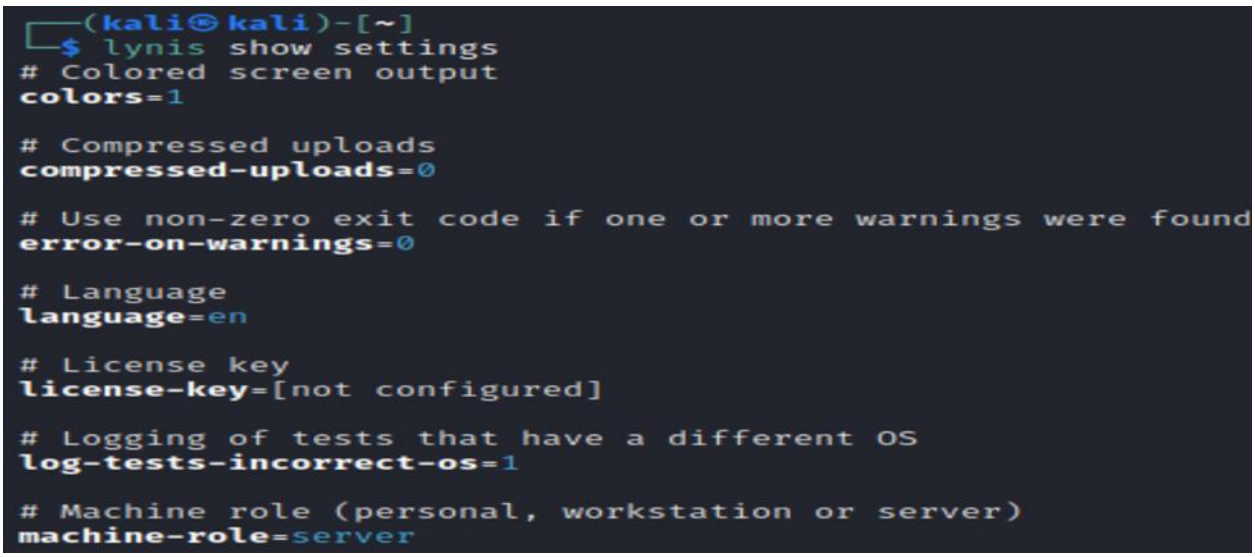
```
┌──(kali㉿kali)-[~]
└─$ sudo ausearch -i -p 15045                                                                                  1 ⨯
----
type=PROCTITLE msg=audit(11/09/2022 20:54:50.066:179) : proctitle=autrace /usr/bin/less
type=SYSCALL msg=audit(11/09/2022 20:54:50.066:179) : arch=x86_64 syscall=close success=yes exit=0 a0=0x4 a1=0x1 a2=
0x7f49e8b9bad8 a3=0x7f49e8c1b028 items=0 ppid=15043 pid=15045 auid=kali uid=root gid=root euid=root suid=root fsuid=
root egid=root sgid=root fsgid=root tty=pts1 ses=2 comm=autrace exe=/usr/sbin/autrace subj==unconfined key=(null)
----
type=PROCTITLE msg=audit(11/09/2022 20:54:50.066:180) : proctitle=autrace /usr/bin/less
type=PATH msg=audit(11/09/2022 20:54:50.066:180) : item=0 name= inode=4 dev=00:15 mode=character,620 ouid=root ogid=
tty rdev=88:01 nametype=NORMAL cap_fp=none cap_fi=none cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(11/09/2022 20:54:50.066:180) : cwd=/home/kali
type=SYSCALL msg=audit(11/09/2022 20:54:50.066:180) : arch=x86_64 syscall=newfstatat success=yes exit=0 a0=0x1 a1=0x
7f49e8b52f15 a2=0x7ffcda618990 a3=0x1000 items=1 ppid=15043 pid=15045 auid=kali uid=root gid=root euid=root suid=roo
t fsuid=root egid=root sgid=root fsgid=root tty=pts1 ses=2 comm=autrace exe=/usr/sbin/autrace subj==unconfined key=(
null)
----
type=PROCTITLE msg=audit(11/09/2022 20:54:50.066:181) : proctitle=autrace /usr/bin/less
type=SYSCALL msg=audit(11/09/2022 20:54:50.066:181) : arch=x86_64 syscall=write success=yes exit=34 a0=0x1 a1=0x55e0
56c5c4d0 a2=0x22 a3=0x7f49e8b4c3e0 items=0 ppid=15043 pid=15045 auid=kali uid=root gid=root euid=root suid=root fsui
d=root egid=root sgid=root fsgid=root tty=pts1 ses=2 comm=autrace exe=/usr/sbin/autrace subj==unconfined key=(null)

type=PROCTITLE msg=audit(11/09/2022 20:54:50.066:183) : proctitle=autrace /usr/bin/less
type=SYSCALL msg=audit(11/09/2022 20:54:50.066:183) : arch=x86_64 syscall=read success=yes exit=1 a0=0x3 a1=0x7ffcda
619110 a2=0x1 a3=0x7f49e8b4c3e0 items=0 ppid=15043 pid=15045 auid=kali uid=root gid=root euid=root suid=root fsuid=r
oot egid=root sgid=root fsgid=root tty=pts1 ses=2 comm=autrace exe=/usr/sbin/autrace subj==unconfined key=(null)
----
type=PROCTITLE msg=audit(11/09/2022 20:54:51.070:184) : proctitle=autrace /usr/bin/less
type=SYSCALL msg=audit(11/09/2022 20:54:51.070:184) : arch=x86_64 syscall=close success=yes exit=0 a0=0x3 a1=0x7ffcd
a619110 a2=0x1 a3=0x7f49e8b4c3e0 items=0 ppid=15043 pid=15045 auid=kali uid=root gid=root euid=root suid=root fsuid=
root egid=root sgid=root fsgid=root tty=pts1 ses=2 comm=autrace exe=/usr/sbin/autrace subj==unconfined key=(null)
```

The second part of the lab involved using Lynis for Security Auditing. This is an auditing tool that used for testing the vulnerability of a system. These include security auditing, compliance testing, penetration testing, vulnerability detection, and system hardening. The first task to do is to install this utility by using **sudo apt-get install lynis.** Here below is the output below.



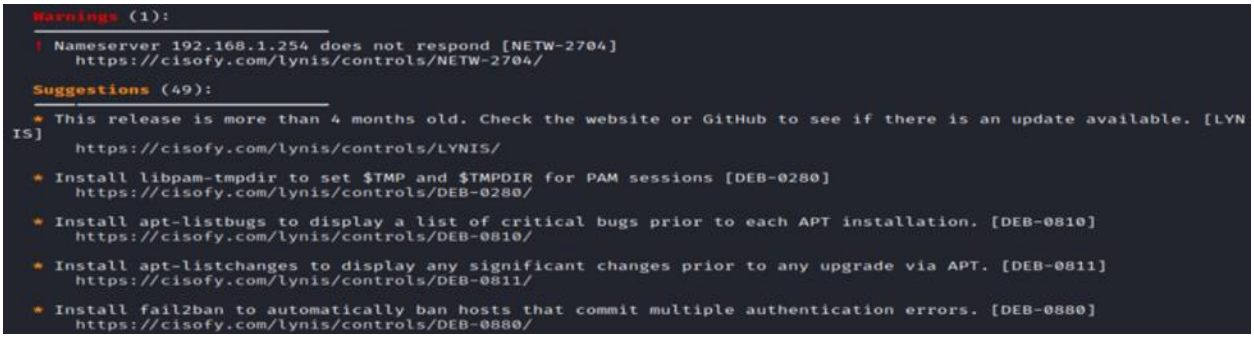
Now that we have installed Lynis into your system, we need to view the commands that are available to use. To show that command, use **lynis show commands.** You can see below the various commands and configuration options.

Lynis has various settings to customize its behavior from. To show the settings, use **lynis show settings** commands. This configuration file is generally located at the /etc/audit directory. Here below is the output.

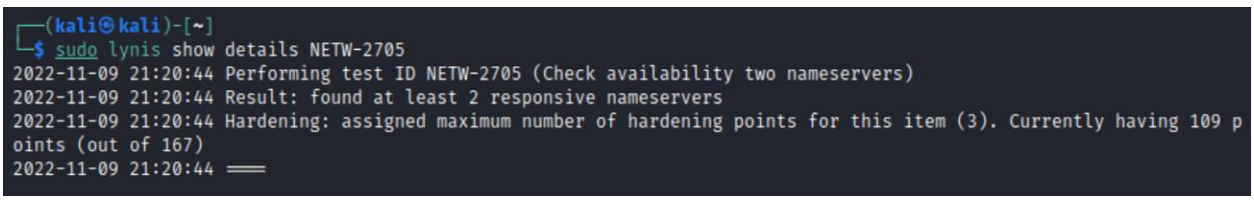


To perform a security auditing on your system, use **sudo lynis audit system.** Note that this will take a while audit your system. If you want a quick audit, use the **--quick** option. Here below is an output of the first section of audit results.

Lynis displays a report when it done running a security audit. These reports include warning and suggestions. There is also a unique identifier. The warning below has the identifier NETW-2704



Now that we know the identifier, we can use **sudo lynis show details NETW-2705** command for more information on this warning. Note that identifier will change depending on your error. This error signifies to check your **resolv.conf** file.



To view the content of this file, use **cat /etc/resolv.conf.** Below are some of nameservers for system. The warning from the Lynis audit report specifies that we need to backup nameservers to the system.

```
┌──(kali㉿kali)-[~]
└─$ cat /etc/resolv.conf
# Generated by NetworkManager
search attlocal.net
nameserver 103.86.96.100
nameserver 103.86.99.100
nameserver 192.168.1.254
```

To resolve it, we will add public DNS servers in the system. First thing is login as a super user. This is done by using the command **sudo su.** This is required because you aren't able add the public DNS using a user account. You need root privilege access. Not doing so will result in this error below. Remember that changes done to the system while as a super user can damage your system Always make sure the changes don't negatively affect your system

```
zsh: permission denied: /etc/resolv.conf
```

Now we can add the name server using **echo nameserver 8.8.8.8>> /etc/resolv.conf, echo nameserver 75.75.75.75>> /etc/resolv.conf,** and **echo nameserver 75.75.76.76>> /etc/resolv.conf** commands. Here below is the output. Note that the skull represents a super user.

```
┌──(root💀kali)-[/home/kali]
└─# echo nameserver 8.8.8.8>> /etc/resolv.conf

┌──(root💀kali)-[/home/kali]
└─# echo nameserver 75.75.75.75>> /etc/resolv.conf

┌──(root💀kali)-[/home/kali]
└─# echo nameserver 75.75.76.76>> /etc/resolv.conf
```

We can view these changes by using **cat /etc/resolv.conf** command. You can see below the domain servers that were added.

```
┌──(kali㉿kali)-[~]
└─$ cat /etc/resolv.conf
# Generated by NetworkManager
search attlocal.net
nameserver 103.86.96.100
nameserver 103.86.99.100
nameserver 192.168.1.254
nameserver 8.8.8.8
nameserver 75.75.75.75
nameserver 75.75.76.76
```

Now we can run the security audit again using **sudo lynis audit system.** Now we can see below that the issue has been resolved.

```
kali@kali [~] sudo lynis audit system
     -[ Lynis 3.0.7 Results ]-

       Great, no warnings
```

Now you can review the score that you get when the security audit is done auditing. Below you can see the score. You can use this information and see what you can do to increase he security of your system. Note that there are different options when scanning.