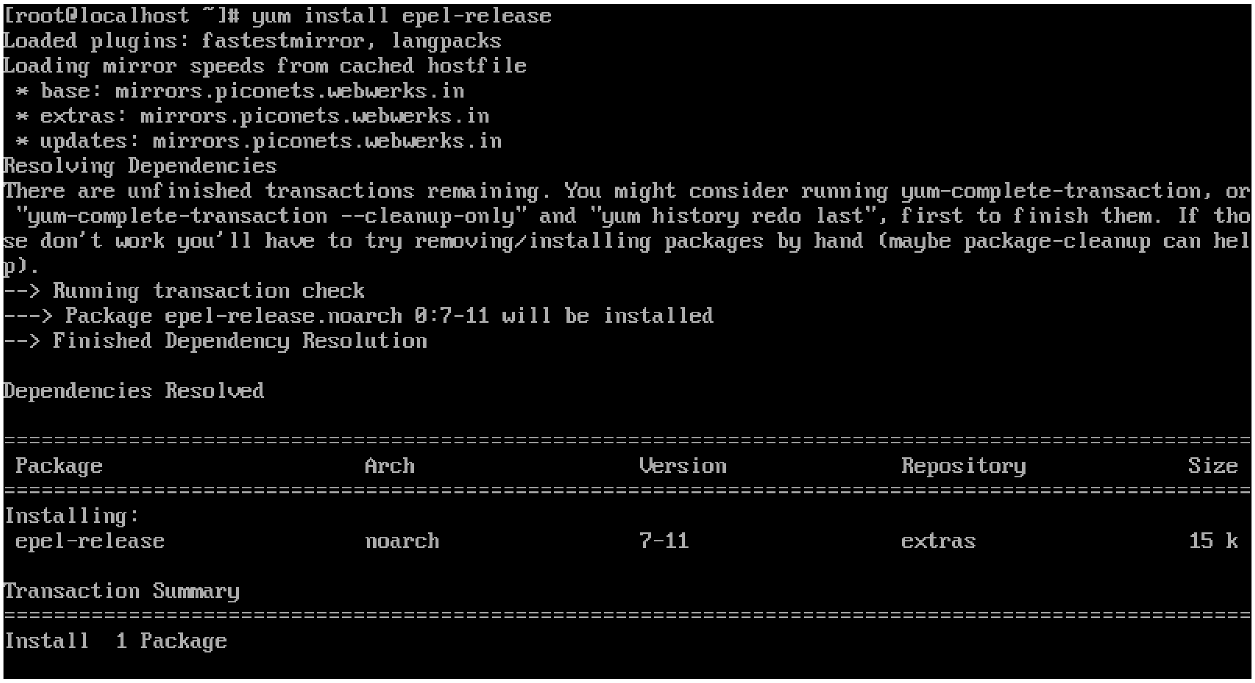
Qno1

Setup a VPN server in VM1(CentOS), we use OpenVPN for this purpose.

To install OpenVPN we will need the EPEL repository, we install EPEL repositories using the following command:

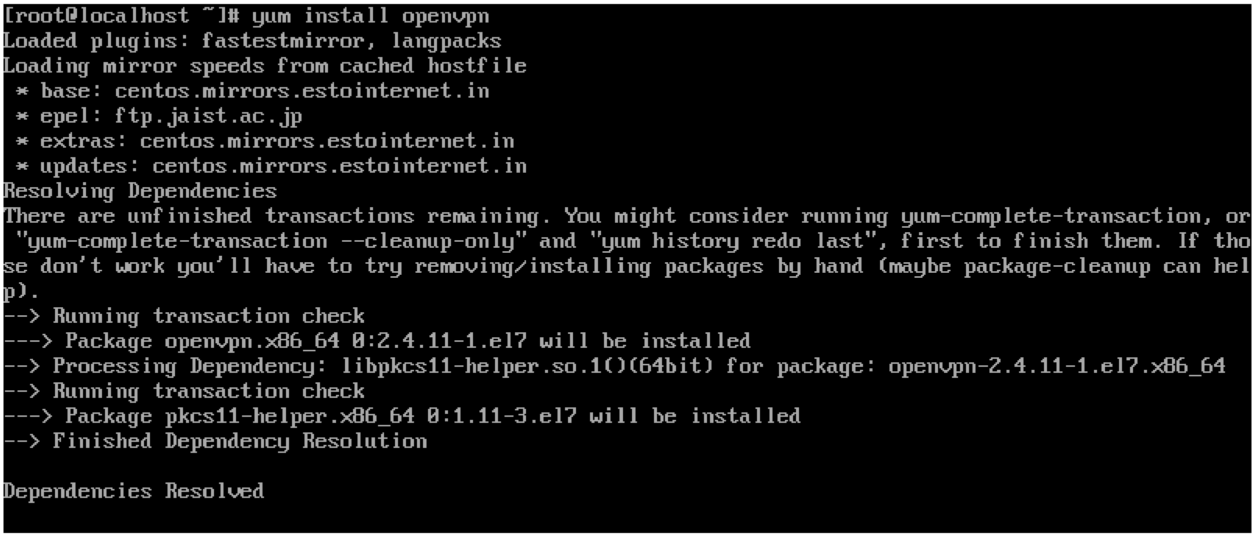
- yum install epel-release



```
[root@localhost ~]# yum install epel-release
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: mirrors.piconets.webwerks.in
 * extras: mirrors.piconets.webwerks.in
 * updates: mirrors.piconets.webwerks.in
Resolving Dependencies
There are unfinished transactions remaining. You might consider running yum-complete-transaction, or
 "yum-complete-transaction --cleanup-only" and "yum history redo last", first to finish them. If tho
se don't work you'll have to try removing/installing packages by hand (maybe package-cleanup can hel
p).
--> Running transaction check
---> Package epel-release.noarch 0:7-11 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

====================================================================================================
 Package                     Arch                  Version              Repository             Size
====================================================================================================
Installing:
 epel-release                noarch                7-11                 extras                 15 k

Transaction Summary
====================================================================================================
Install  1 Package
```

To install the OpenVPN server, we install OpenVPN using the following command:

- yum install openvpn

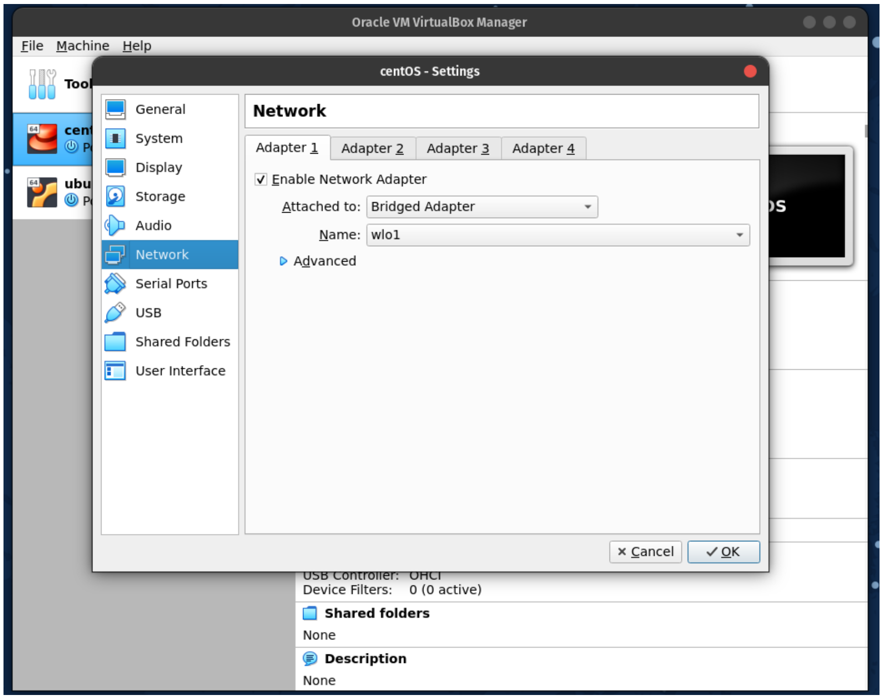


```
[root@localhost ~]# yum install openvpn
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: centos.mirrors.estointernet.in
 * epel: ftp.jaist.ac.jp
 * extras: centos.mirrors.estointernet.in
 * updates: centos.mirrors.estointernet.in
Resolving Dependencies
There are unfinished transactions remaining. You might consider running yum-complete-transaction, or
 "yum-complete-transaction --cleanup-only" and "yum history redo last", first to finish them. If tho
se don't work you'll have to try removing/installing packages by hand (maybe package-cleanup can hel
p).
--> Running transaction check
---> Package openvpn.x86_64 0:2.4.11-1.el7 will be installed
--> Processing Dependency: libpkcs11-helper.so.1()(64bit) for package: openvpn-2.4.11-1.el7.x86_64
--> Running transaction check
---> Package pkcs11-helper.x86_64 0:1.11-3.el7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved
```

Qno1(a)

The first VM has two Network Interface one for WAN and another for LAN.

- Adaptor 1



Oracle VM VirtualBox Manager

centOS - Settings

Network

☑ Enable Network Adapter

Attached to: Bridged Adapter

Name: wlo1

USB Controller: OHCI
Device Filters: 0 (0 active)

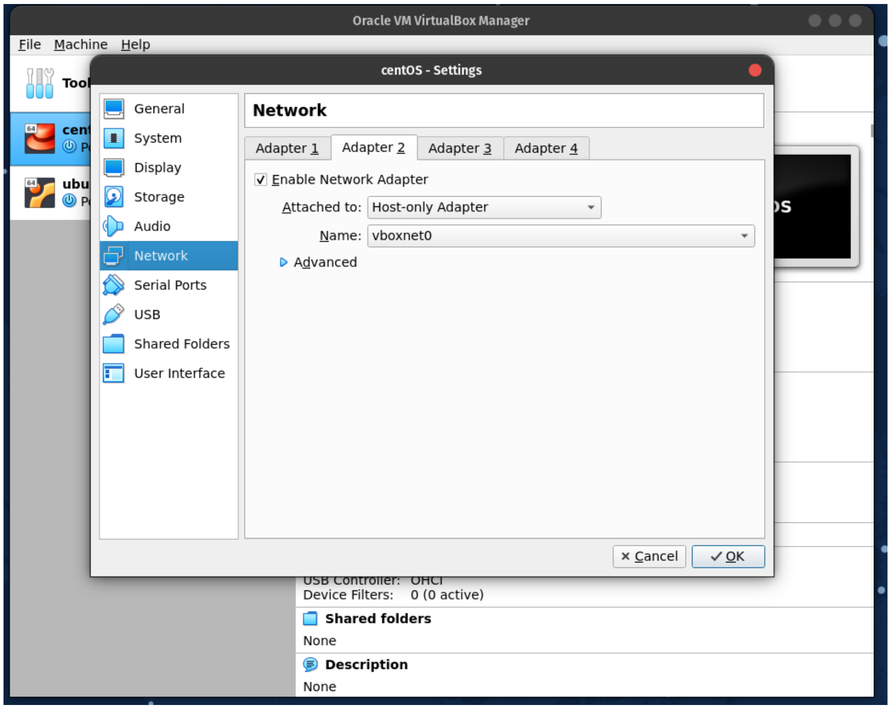
Shared folders

None

Description

None

- Adaptor 2



Oracle VM VirtualBox Manager

centOS - Settings

Network

☑ Enable Network Adapter

Attached to: Host-only Adapter

Name: vboxnet0

USB Controller: OHCI
Device Filters: 0 (0 active)

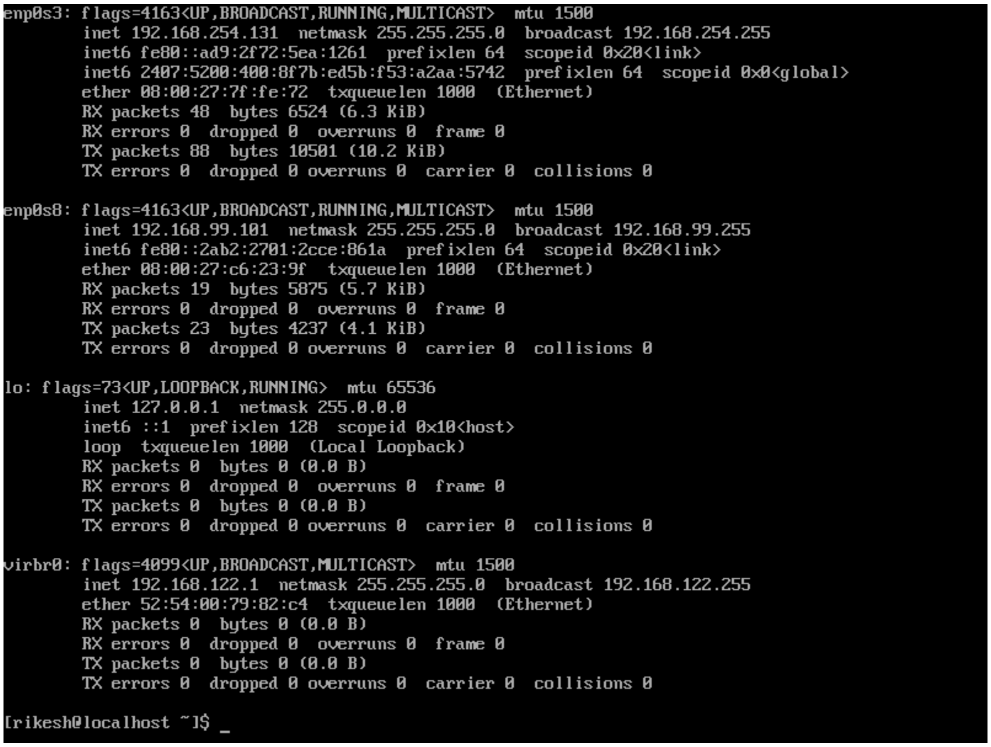
Shared folders

None

Description

None

the configuration/ information of all the network interfaces currently in operation on the system is checked using ifconfig

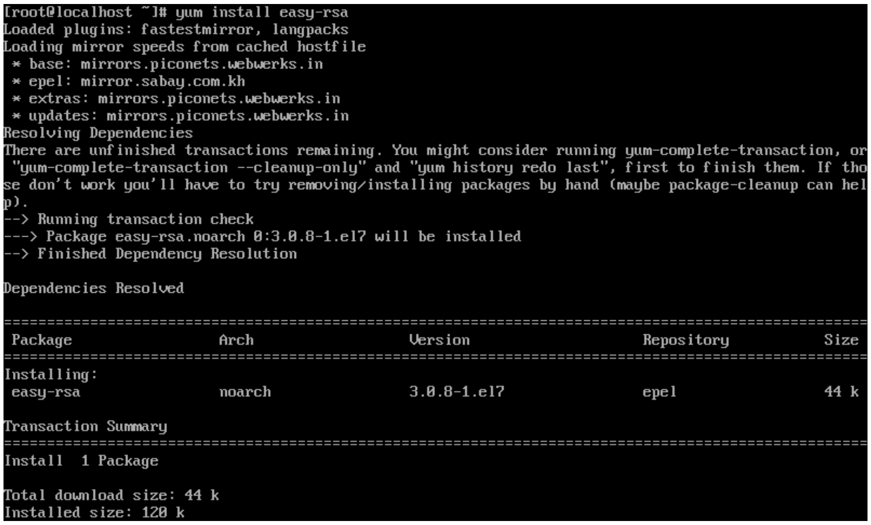


```
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.254.131  netmask 255.255.255.0  broadcast 192.168.254.255
        inet6 fe80::ad9:2f72:5ea:1261  prefixlen 64  scopeid 0x20<link>
        inet6 2407:5200:400:8f7b:ed5b:f53:a2aa:5742  prefixlen 64  scopeid 0x0<global>
        ether 08:00:27:7f:fe:72  txqueuelen 1000  (Ethernet)
        RX packets 48  bytes 6524 (6.3 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 88  bytes 10501 (10.2 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.99.101  netmask 255.255.255.0  broadcast 192.168.99.255
        inet6 fe80::2ab2:2701:2cce:861a  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:c6:23:9f  txqueuelen 1000  (Ethernet)
        RX packets 19  bytes 5875 (5.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 23  bytes 4237 (4.1 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

virbr0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 192.168.122.1  netmask 255.255.255.0  broadcast 192.168.122.255
        ether 52:54:00:79:82:c4  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

[rikesh@localhost ~]$ _
```

Qno1(b)

To create certificates files for both server and client to connect to server and export client certificates to the client vm.
Install easy-rsa first to create certificates using the command:

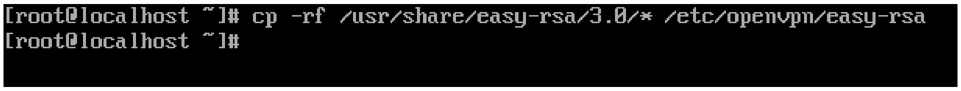
- yum install easy-rsa



```
[root@localhost ~]# yum install easy-rsa
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: mirrors.piconets.webwerks.in
 * epel: mirror.sabay.com.kh
 * extras: mirrors.piconets.webwerks.in
 * updates: mirrors.piconets.webwerks.in
Resolving Dependencies
There are unfinished transactions remaining. You might consider running yum-complete-transaction, or
 "yum-complete-transaction --cleanup-only" and "yum history redo last", first to finish them. If tho
se don't work you'll have to try removing/installing packages by hand (maybe package-cleanup can hel
p).
--> Running transaction check
---> Package easy-rsa.noarch 0:3.0.8-1.el7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

====================================================================================================
 Package                Arch                  Version                        Repository        Size
====================================================================================================
Installing:
 easy-rsa               noarch                3.0.8-1.el7                    epel              44 k

Transaction Summary
====================================================================================================
Install  1 Package

Total download size: 44 k
Installed size: 120 k
```

Now make a new directory for easy-rsa to store the certificates, keys:

- mkdir -p /etc/openvpn/easy-rsa/keys
  - *p*- make required directories
- cp -rf /usr/share/easy-rsa/2.0/* /etc/openvpn/easy-rsa
  - *r*- copy recursively
  - *f*- force this/ accept

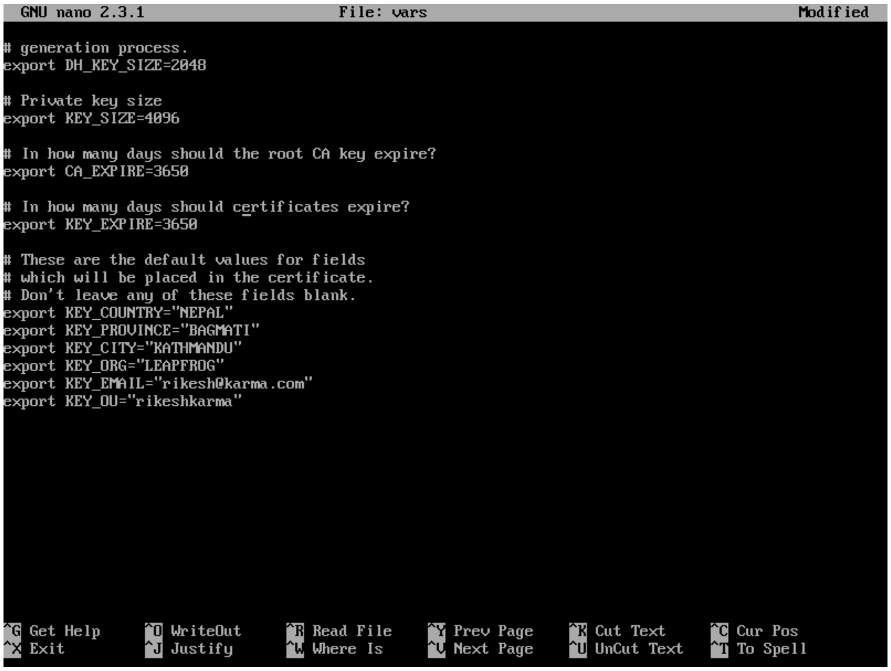


```
[root@localhost ~]# cp -rf /usr/share/easy-rsa/3.0/* /etc/openvpn/easy-rsa
[root@localhost ~]#
```

Change the variables file in the easy-rsa folder

- nano /etc/openvpn/easy-rsa/vars

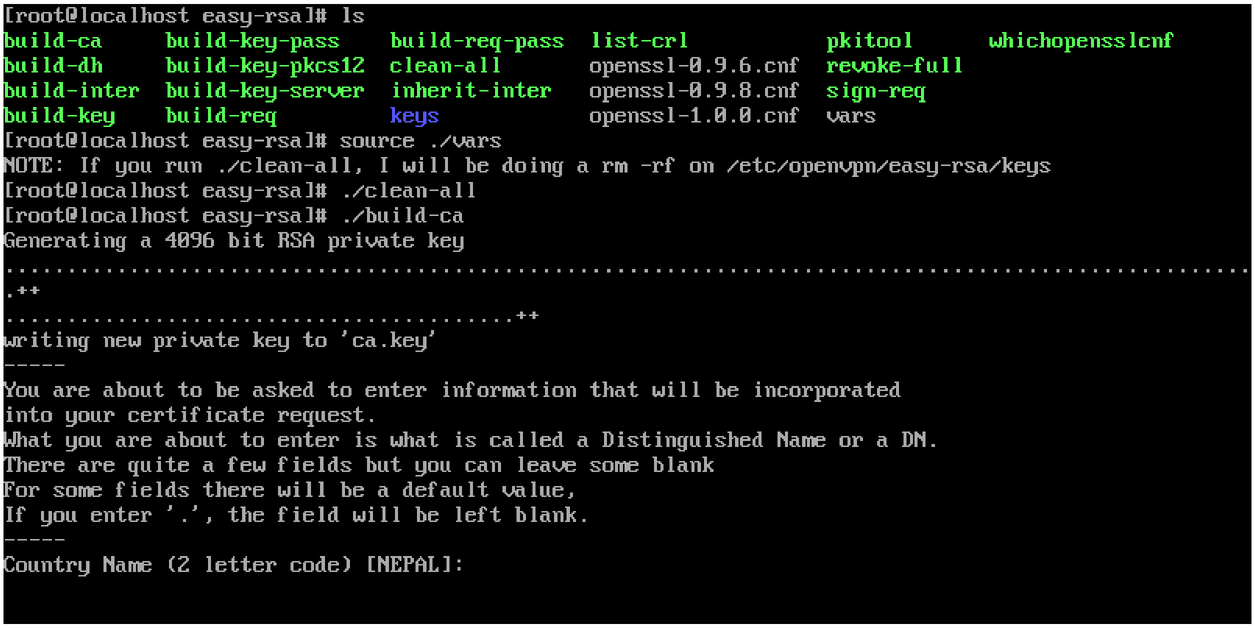
Edit as per requirement



```
  GNU nano 2.3.1                 File: vars                                Modified

# generation process.
export DH_KEY_SIZE=2048

# Private key size
export KEY_SIZE=4096

# In how many days should the root CA key expire?
export CA_EXPIRE=3650

# In how many days should certificates expire?
export KEY_EXPIRE=3650

# These are the default values for fields
# which will be placed in the certificate.
# Don't leave any of these fields blank.
export KEY_COUNTRY="NEPAL"
export KEY_PROVINCE="BAGMATI"
export KEY_CITY="KATHMANDU"
export KEY_ORG="LEAPFROG"
export KEY_EMAIL="rikesh@karma.com"
export KEY_OU="rikeshkarma"
```

Now we build the security of our server security certificates and keys. while on the /etc/openvpn/easy-rsa, we use the following commands:

- source ./vars
  - to build our certificate of authority
- ./clean-all
  - clean if any keys are already existing
- /build-ca
  - signing our server and client's certificates
- ./build-key-server $(hostname)
  - add our hostname to the script file

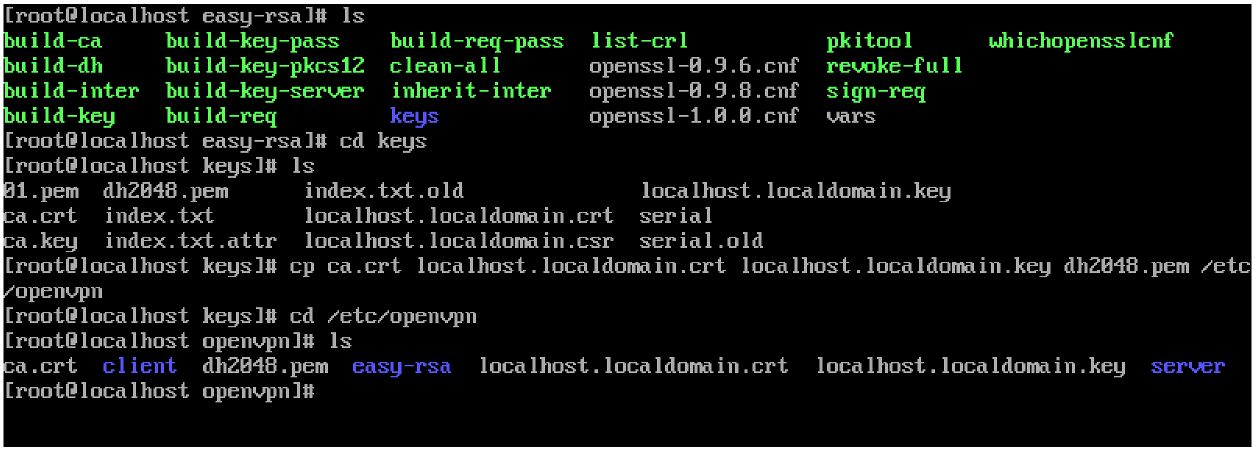


```
[root@localhost easy-rsa]# ls
build-ca     build-key-pass    build-req-pass  list-crl           pkitool     whichopensslcnf
build-dh     build-key-pkcs12  clean-all       openssl-0.9.6.cnf  revoke-full
build-inter  build-key-server  inherit-inter   openssl-0.9.8.cnf  sign-req
build-key    build-req         keys            openssl-1.0.0.cnf  vars
[root@localhost easy-rsa]# source ./vars
NOTE: If you run ./clean-all, I will be doing a rm -rf on /etc/openvpn/easy-rsa/keys
[root@localhost easy-rsa]# ./clean-all
[root@localhost easy-rsa]# ./build-ca
Generating a 4096 bit RSA private key
....................................................................................................
.++
.........................................++
writing new private key to 'ca.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [NEPAL]:
```

- ./build-dh
  - building our diffie-hellman
  - function to exchange keys securely over the internet or over a network

Now we copy the server certificates and keys to the openvpn folder using the command:

- cd /etc/openvpn/easy-rsa/keys
- cp ca.crt localhost.localdomain.crt localhost.localdomain.key dh2048.pem /etc/openvpn

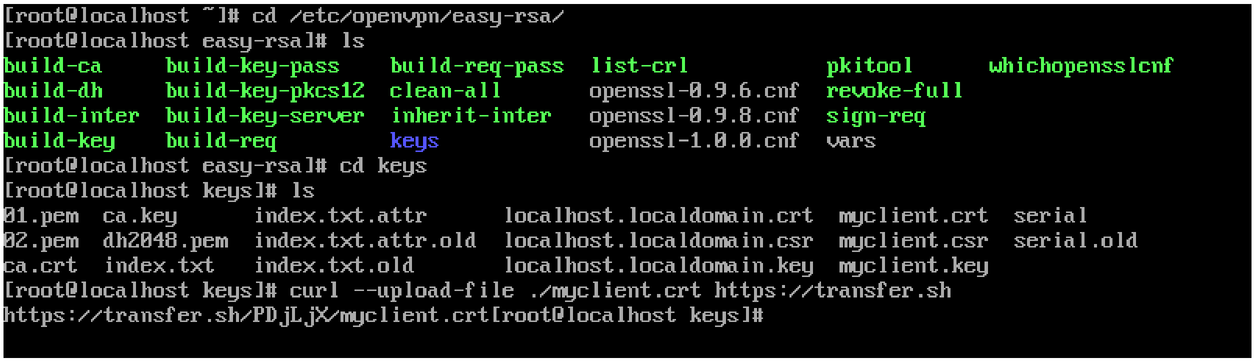


```
[root@localhost easy-rsa]# ls
build-ca     build-key-pass    build-req-pass  list-crl           pkitool     whichopensslcnf
build-dh     build-key-pkcs12  clean-all       openssl-0.9.6.cnf  revoke-full
build-inter  build-key-server  inherit-inter   openssl-0.9.8.cnf  sign-req
build-key    build-req         keys            openssl-1.0.0.cnf  vars
[root@localhost easy-rsa]# cd keys
[root@localhost keys]# ls
01.pem  dh2048.pem      index.txt.old              localhost.localdomain.key
ca.crt  index.txt       localhost.localdomain.crt  serial
ca.key  index.txt.attr  localhost.localdomain.csr  serial.old
[root@localhost keys]# cp ca.crt localhost.localdomain.crt localhost.localdomain.key dh2048.pem /etc
/openvpn
[root@localhost keys]# cd /etc/openvpn
[root@localhost openvpn]# ls
ca.crt  client  dh2048.pem  easy-rsa  localhost.localdomain.crt  localhost.localdomain.key  server
[root@localhost openvpn]#
```

Generating Client Keys

To build the client keys we navigate to `/etc/openvpn/easy-rsa` and run the command

- source ./vars
- ./build-key client

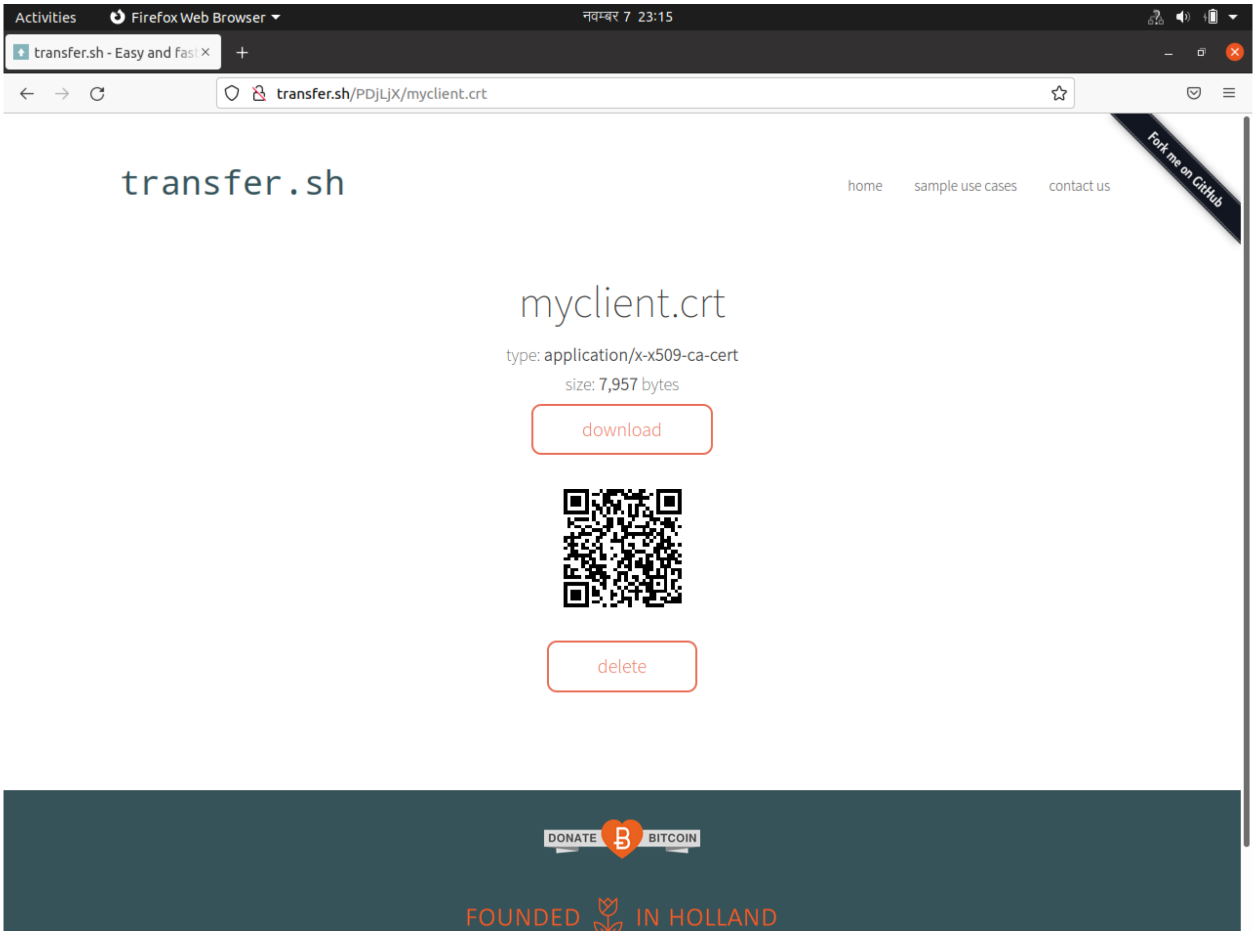


```
[root@localhost ~]# cd /etc/openvpn/easy-rsa/
[root@localhost easy-rsa]# ls
build-ca     build-key-pass    build-req-pass  list-crl           pkitool      whichopensslcnf
build-dh     build-key-pkcs12  clean-all       openssl-0.9.6.cnf  revoke-full
build-inter  build-key-server  inherit-inter   openssl-0.9.8.cnf  sign-req
build-key    build-req         keys            openssl-1.0.0.cnf  vars
[root@localhost easy-rsa]# cd keys
[root@localhost keys]# ls
01.pem  ca.key      index.txt.attr      localhost.localdomain.crt  myclient.crt  serial
02.pem  dh2048.pem  index.txt.attr.old  localhost.localdomain.csr  myclient.csr  serial.old
ca.crt  index.txt   index.txt.old       localhost.localdomain.key  myclient.key
[root@localhost keys]# curl --upload-file ./myclient.crt https://transfer.sh
https://transfer.sh/PDjLjX/myclient.crt[root@localhost keys]#
```

Now change the directory to `keys` folder and verify myclient keys, we should see `myclient.crt myclient.key`.

To export client certificates to the client VM we can use a flash drive, email, or SSH/SCP client like Filezilla.

1. let's send the file via cURL
2. navigate to the `/etc/openvpn/easy-rsa/keys`
3. use the following command:
    a. curl --upload-file ./myclient.crt https://transfer.sh



transfer.sh/PDjLjX/myclient.crt

myclient.crt

type: application/x-x509-ca-cert

size: 7,957 bytes

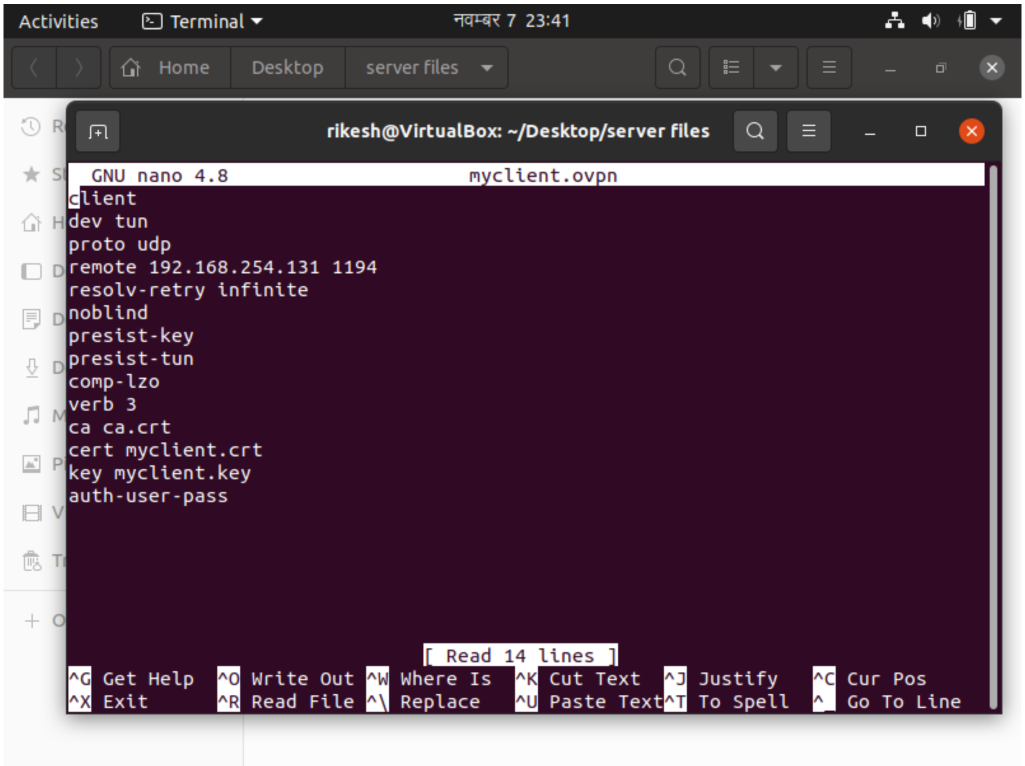
Qno2

Create an OpenVPN client connect configuration file used to connect to the server

Created a text file myclient.ovpn using `touch myclient.ovpn` in the same directory as the files received from the server machine/ VM.

Add the following lines which helps to connect to the server and this also provides the certificates:

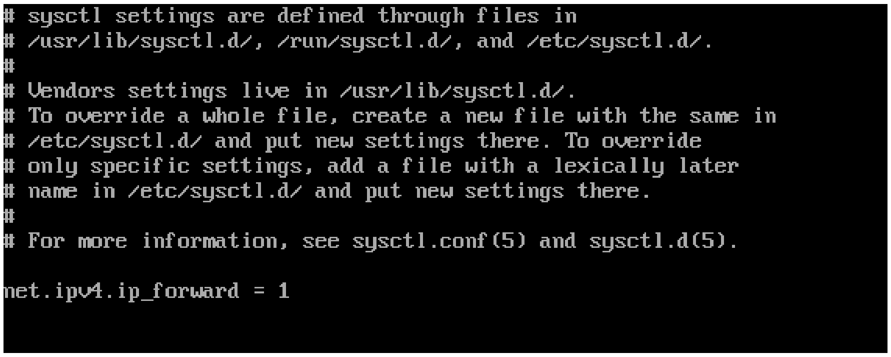
```
client
dev tun
proto udp
remote 192.168.254.131 1194
resolv-retry infinite
nobind
persist-key
persist-tun
comp-lzo
verb 3
ca ca.crt
cert myclient.crt
key myclient.key
auth-user-pass
```



```
  GNU nano 4.8                          myclient.ovpn
client
dev tun
proto udp
remote 192.168.254.131 1194
resolv-retry infinite
noblind
presist-key
presist-tun
comp-lzo
verb 3
ca ca.crt
cert myclient.crt
key myclient.key
auth-user-pass




                                [ Read 14 lines ]
^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Paste Text^T To Spell    ^_ Go To Line
```

On the server, the first VM(CentOS) enable to forward packets through its network interface
Use sysctl to allow IP packet forwarding. Add the following line to the _sysctl.conf_ file

- nano /etc/sysctl.conf
    - net.ipv4.ip_forward = 1



```
# sysctl settings are defined through files in
# /usr/lib/sysctl.d/, /run/sysctl.d/, and /etc/sysctl.d/.
#
# Vendors settings live in /usr/lib/sysctl.d/.
# To override a whole file, create a new file with the same in
# /etc/sysctl.d/ and put new settings there. To override
# only specific settings, add a file with a lexically later
# name in /etc/sysctl.d/ and put new settings there.
#
# For more information, see sysctl.conf(5) and sysctl.d(5).

net.ipv4.ip_forward = 1
```

- sysctl -p

Enable OpenVPN pam authentication module to add user authentication
Using the OpenVPN auth-pam module the OpenVPN server can authenticate using the Linux system users. For this we need to create a PAM service file using the following commands:

- touch /etc/pam.d/openvpn
- nano /etc/pam.d/openvpn

Then we need to add the following two lines to the file:

```
auth required  pam_unix.so shadow  nodelay
account required pam_unix.so
```

Now restart the OpenVPN server

- systemctl stop openvpn@server.service
- systemctl start openvpn@server.service
- systemctl status openvpn@server.service`

Install and configure OpenVPN on the client's machine/ VM2.
Install openvpn-client on VM2(Ubuntu) using the command:

- sudo apt install openvpn

Connect the VM2 to the server/ VM1 using the command:

- sudo openvpn --config client.ovpn

After this OpenVPN will be running in the terminal window.

Qno3

Research on IDS/ IPS

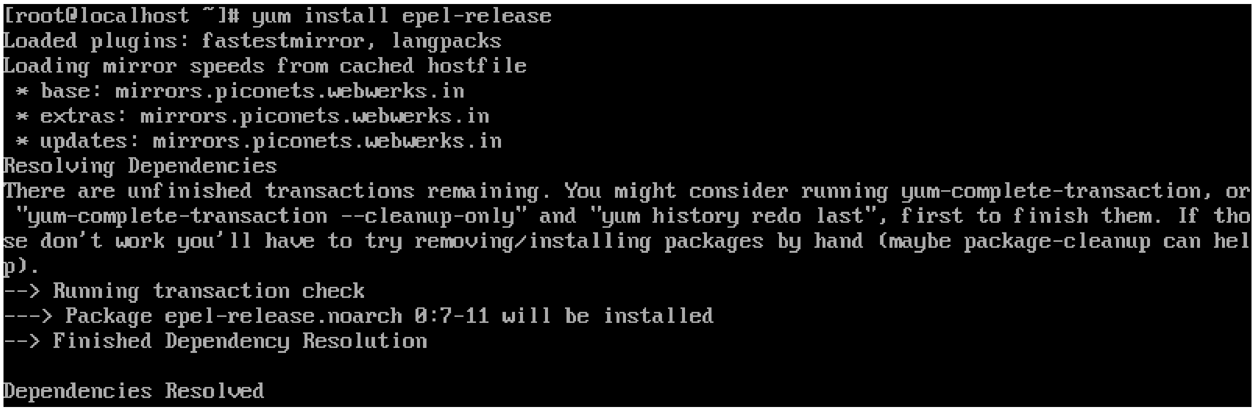
Intrusion detection systems (IDS) and intrusion prevention systems (IPS) constantly watch your network, identify possible incidents, log information about them, stop the incidents, and report them to security administrators. In addition, some networks use IDS/IPS for identifying problems with security policies and deterring individuals from violating security policies. IDS/IPS have become a necessary addition to the security infrastructure of most organizations, precisely because they can stop attackers while they are gathering information about your network. There are many applications that provide IDS/IPS service and one of them is Suricata.

Suricata

Suricata is the leading independent open source threat detection engine. By combining intrusion detection (IDS), intrusion prevention (IPS), network security monitoring (NSM), and PCAP processing, Suricata can quickly identify, stop, and assess the most sophisticated attacks.

Let's first install EPEL repositories using the following command:

- yum install epel-release



```
[root@localhost ~]# yum install epel-release
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: mirrors.piconets.webwerks.in
 * extras: mirrors.piconets.webwerks.in
 * updates: mirrors.piconets.webwerks.in
Resolving Dependencies
There are unfinished transactions remaining. You might consider running yum-complete-transaction, or
 "yum-complete-transaction --cleanup-only" and "yum history redo last", first to finish them. If tho
se don't work you'll have to try removing/installing packages by hand (maybe package-cleanup can hel
p).
--> Running transaction check
---> Package epel-release.noarch 0:7-11 will be installed
--> Finished Dependency Resolution

Dependencies Resolved
```

After installing epl-release check for these additional packages and install them if not available on your system:
gcc flex bison zlib-devel libdnet-devel libpcap-devel pcre-devel et-devel tar make libnetfilter_queue-devel lua-devel PyYAML libmaxminddb-devel rustc cargo lz4-devel libyaml-devel file-devel jansson-devel nss-devel libcap-ng-devel

Install Suricata using:

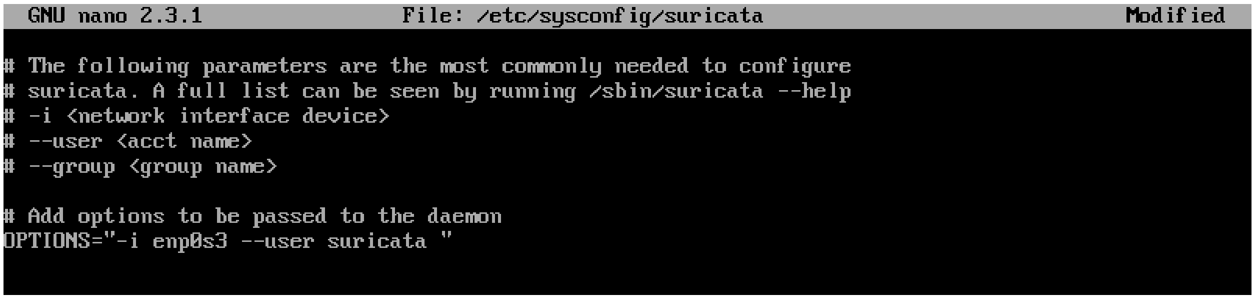
- yum install suricata

Now we need to update the rules to get the Emerging Threats Open ruleset. As Suricata does not ship with rules by default we run the following command:

- suricata-update

Configuring the network interface for suricata from the file `/etc/sysconfig/suricata` by editing the last line to:

- OPTIONS="-i enp0s3 --user suricata"



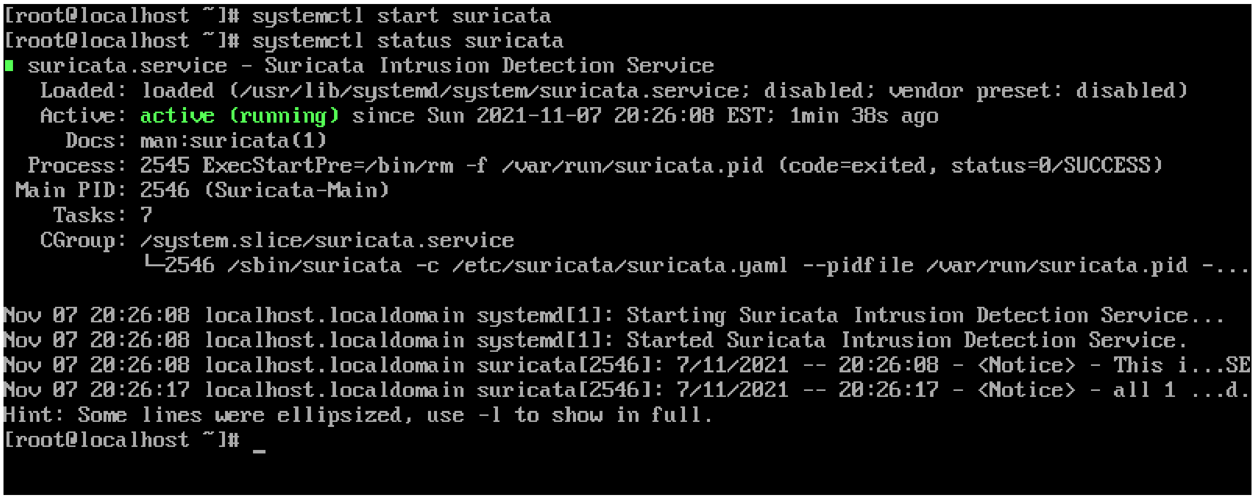
```
  GNU nano 2.3.1               File: /etc/sysconfig/suricata                        Modified

# The following parameters are the most commonly needed to configure
# suricata. A full list can be seen by running /sbin/suricata --help
# -i <network interface device>
# --user <acct name>
# --group <group name>

# Add options to be passed to the daemon
OPTIONS="-i enp0s3 --user suricata "
```

Starting the Suricata by using this command in the terminal:

- systemctl start suricata

We can check the status to verify by:

- systemctl status suricata



```
[root@localhost ~]# systemctl start suricata
[root@localhost ~]# systemctl status suricata
■ suricata.service - Suricata Intrusion Detection Service
   Loaded: loaded (/usr/lib/systemd/system/suricata.service; disabled; vendor preset: disabled)
   Active: active (running) since Sun 2021-11-07 20:26:08 EST; 1min 38s ago
     Docs: man:suricata(1)
  Process: 2545 ExecStartPre=/bin/rm -f /var/run/suricata.pid (code=exited, status=0/SUCCESS)
 Main PID: 2546 (Suricata-Main)
    Tasks: 7
   CGroup: /system.slice/suricata.service
           └─2546 /sbin/suricata -c /etc/suricata/suricata.yaml --pidfile /var/run/suricata.pid -...

Nov 07 20:26:08 localhost.localdomain systemd[1]: Starting Suricata Intrusion Detection Service...
Nov 07 20:26:08 localhost.localdomain systemd[1]: Started Suricata Intrusion Detection Service.
Nov 07 20:26:08 localhost.localdomain suricata[2546]: 7/11/2021 -- 20:26:08 - <Notice> - This i...SE
Nov 07 20:26:17 localhost.localdomain suricata[2546]: 7/11/2021 -- 20:26:17 - <Notice> - all 1 ...d.
Hint: Some lines were ellipsized, use -l to show in full.
[root@localhost ~]# _
```

Now let's add new sample rules, for we navigate to `/usr/share/suricate/rules/` and nano the `test.rules` file in the directory.And add the following line to the `test.rules` file:

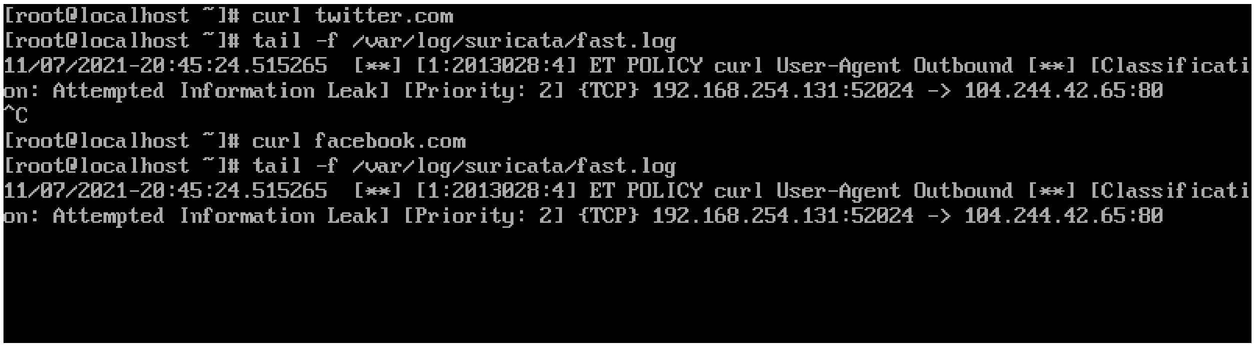
- alert http any any -> any any (msg:"Do not read gossip during work"; content:"Scarlett"; nocase; classtype:policy-violation; sid:1; rev:1;)

Then we need to add the rules name in `/usr/share/suricata/rules/suricata.yaml`by appending the following line under the rule-files:

- usr/share/suricata/rules/test.rules

Lastly we can see the events taking place on the system by tailing the suricata alert logs on suricata host by:

- tail -f /var/log/suricata/fast.log



```
[root@localhost ~]# curl twitter.com
[root@localhost ~]# tail -f /var/log/suricata/fast.log
11/07/2021-20:45:24.515265  [**] [1:2013028:4] ET POLICY curl User-Agent Outbound [**] [Classificati
on: Attempted Information Leak] [Priority: 2] {TCP} 192.168.254.131:52024 -> 104.244.42.65:80
^C
[root@localhost ~]# curl facebook.com
[root@localhost ~]# tail -f /var/log/suricata/fast.log
11/07/2021-20:45:24.515265  [**] [1:2013028:4] ET POLICY curl User-Agent Outbound [**] [Classificati
on: Attempted Information Leak] [Priority: 2] {TCP} 192.168.254.131:52024 -> 104.244.42.65:80
```