Remote Access VPN with FreeRADIUS and OpenLDAP - Debian

-Setup

-Domain: wsc2022.kr
-Public subnet: 10.10.10.0/24
Debian server: 10.10.10.1/24
Windows client: 10.10.10.10/24
Debian client: 10.10.10.100/24
-Private subnet: 192.168.100.0/24
Debian server: 192.168.100.100/24
-VPN private IP pool: 192.168.3.0/24
-Users in FreeRADIUS
-alice
-bob
-Users in LDAP:
-cecil
-dennis

-Install slapd, freeradius, freeradius-ldap, strongswan and it's plugins

```
apt install slapd freeradius freeradius-ldap strongswan strongswan-pki libcharon-extra-plugins
```

-Create a CA and create the certs

-Create the directories

```
mkdir -p ~/pki/{cacerts,certs,private}
chmod 700 ~/pki
```

-Generate the key

```
pki --gen --type rsa --size 4096 --outform pem > ~/pki/private/ca-key.pem
```

-Sign the root cert

```
pki --self --ca --lifetime 3650 --in ~/pki/private/ca-key.pem --type rsa --dn "CN=vpn.wsc2022.kr" --outform pem > ~/pki/cacerts/ca-cert.pem
```

-Generate a private key for the VPN server

```
pki --gen --type rsa --size 4096 --outform pem > ~/pki/private/server-key.pem
```

-Create and sign the VPN server cert. If you use the DNS name of the server in the CN and SAN fields you’ll only need one SAN field

```
pki --pub --in ~/pki/private/server-key.pem --type rsa | pki --issue --lifetime 1825 --cacert ~/pki/cacerts/ca-cert.pem --cakey ~/pki/private/ca-key.pem --dn “CN=10.10.10.1” --san @10.10.10.1 --san 10.10.10.1 --flag serverAuth --flag ikeIntermediate --outform pem > ~/pki/certs/server-cert.pem
```

-Copy the certs and keys to /etc/ipsec.d and /etc/freeradius/3.0

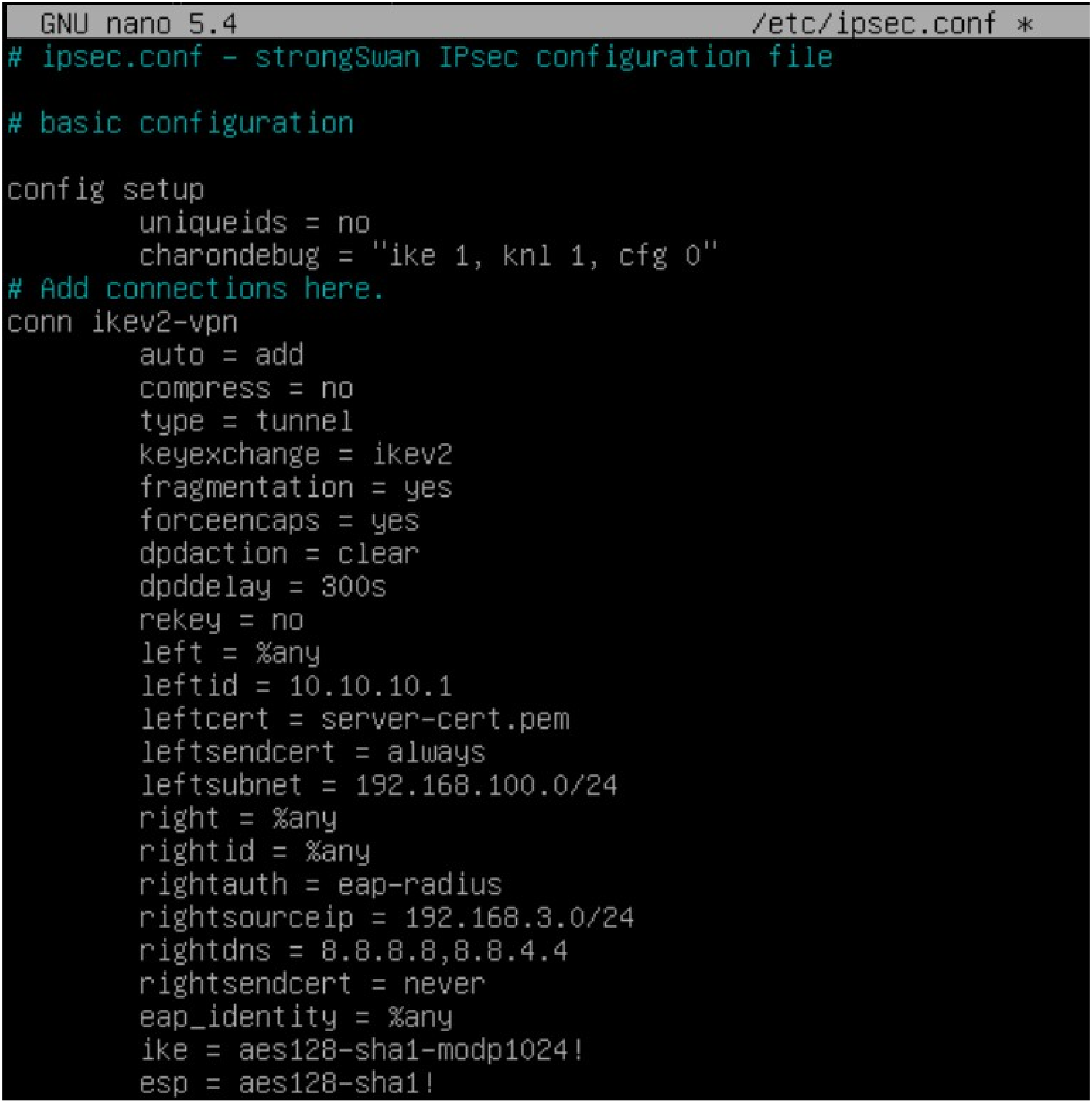
```
cp -r ~/pki/* /etc/ipsec.d
cp -r ~/pki/* /etc/freeradius/3.0
```

-Configure Strongswan-

-Edit /etc/ipsec.conf

```
config setup
        uniqueids = no
        charondebug = “ike 1, knl 1, cfg 0”
conn ikev2-vpn
        auto = add
        compress = no
         type = tunnel
        keyexchange = ikev2
```

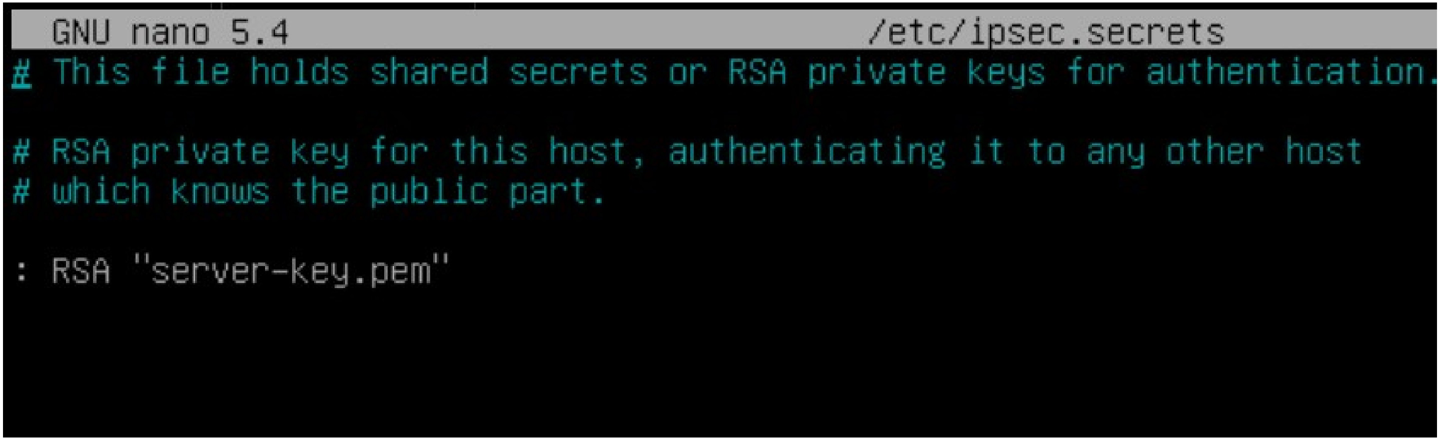
```
fragmentation = yes
forceencaps = yes
dpdaction = clear
dpddelay = 300s
rekey = no
left = %any
leftid = 10.10.10.1 #you can use a domain name aswell: leftid = @domain.tld
leftcert = server-cert.pem
leftsendcert = always
leftsubnet = 192.168.100.0/24
right = %any
rightid = %any
rightauth = eap-radius
rightsourceip = 192.168.3.0/24
rightdns = 8.8.8.8,8.8.4.4
rightsendcert = never
eap_identity = %identity
ike = aes128-sha1-modp1024!
esp = aes128-sha1!
```



```
  GNU nano 5.4                                    /etc/ipsec.conf *
# ipsec.conf - strongSwan IPsec configuration file

# basic configuration

config setup
        uniqueids = no
        charondebug = "ike 1, knl 1, cfg 0"
# Add connections here.
conn ikev2-vpn
        auto = add
        compress = no
        type = tunnel
        keyexchange = ikev2
        fragmentation = yes
        forceencaps = yes
        dpdaction = clear
        dpddelay = 300s
        rekey = no
        left = %any
        leftid = 10.10.10.1
        leftcert = server-cert.pem
        leftsendcert = always
        leftsubnet = 192.168.100.0/24
        right = %any
        rightid = %any
        rightauth = eap-radius
        rightsourceip = 192.168.3.0/24
        rightdns = 8.8.8.8,8.8.4.4
        rightsendcert = never
        eap_identity = %any
        ike = aes128-sha1-modp1024!
        esp = aes128-sha1!
```

-Edit /etc/ipsec.secrets

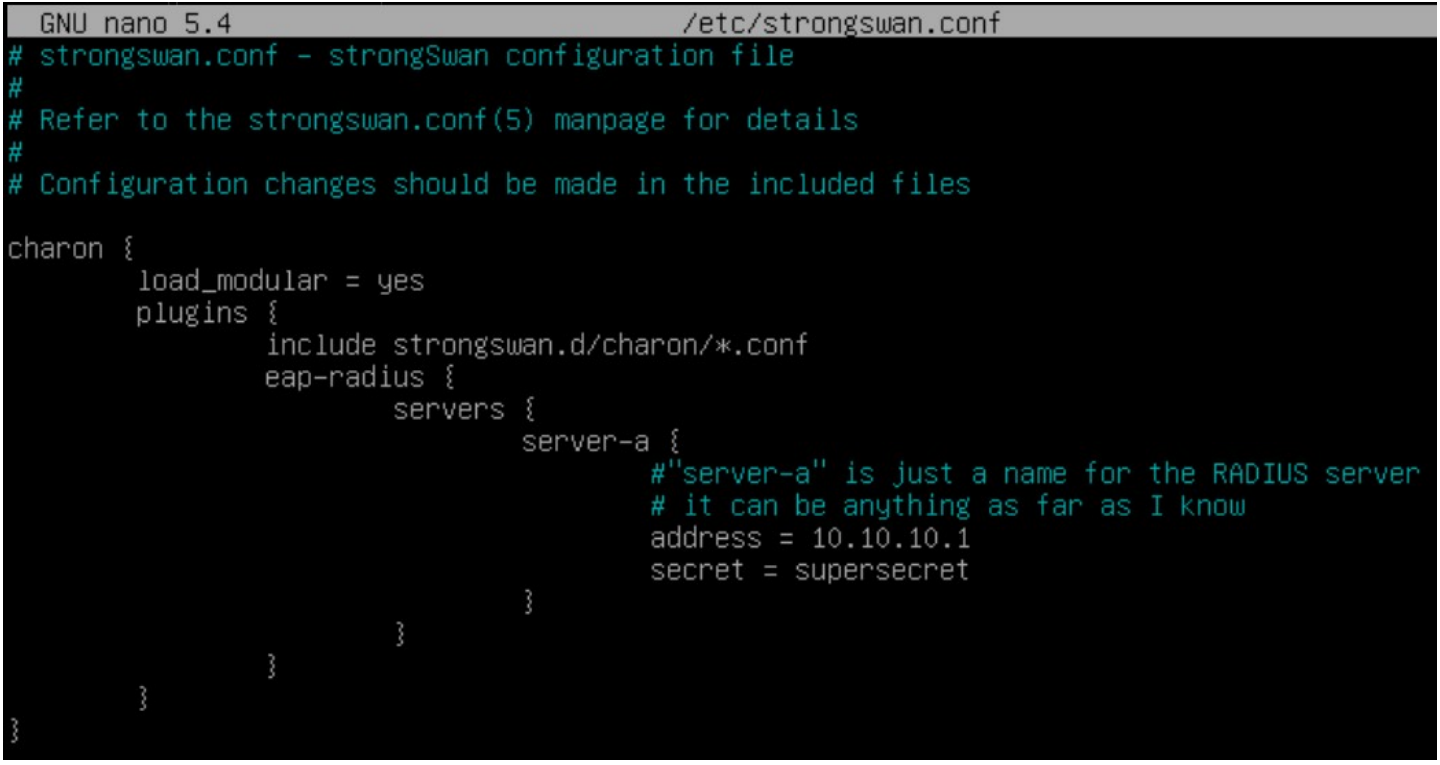
: RSA “server-key.pem”



```
  GNU nano 5.4                                /etc/ipsec.secrets
# This file holds shared secrets or RSA private keys for authentication.

# RSA private key for this host, authenticating it to any other host
# which knows the public part.

: RSA "server-key.pem"
```

-Edit /etc/strongswan.conf

-In the plugins module define the eap-radius module and the radius server itself



```
  GNU nano 5.4                              /etc/strongswan.conf
# strongswan.conf - strongSwan configuration file
#
# Refer to the strongswan.conf(5) manpage for details
#
# Configuration changes should be made in the included files

charon {
        load_modular = yes
        plugins {
                include strongswan.d/charon/*.conf
                eap-radius {
                        servers {
                                server-a {
                                        #"server-a" is just a name for the RADIUS server
                                        # it can be anything as far as I know
                                        address = 10.10.10.1
                                        secret = supersecret
                                }
                        }
                }
        }
}
```

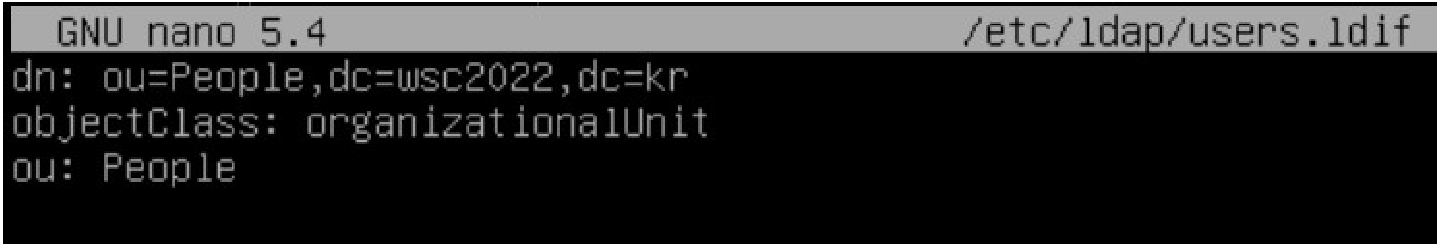
-Configure Slapd-

-Reconfigure slapd

dpkg-reconfigure slapd

-Add a users group by creating a new LDIF file in /etc/ldap/ and adding the following content

nano /etc/ldap/users.ldif
dn: ou=People,dc=wsc2022,dc=kr
objectClass: organizationalUnit
ou: People



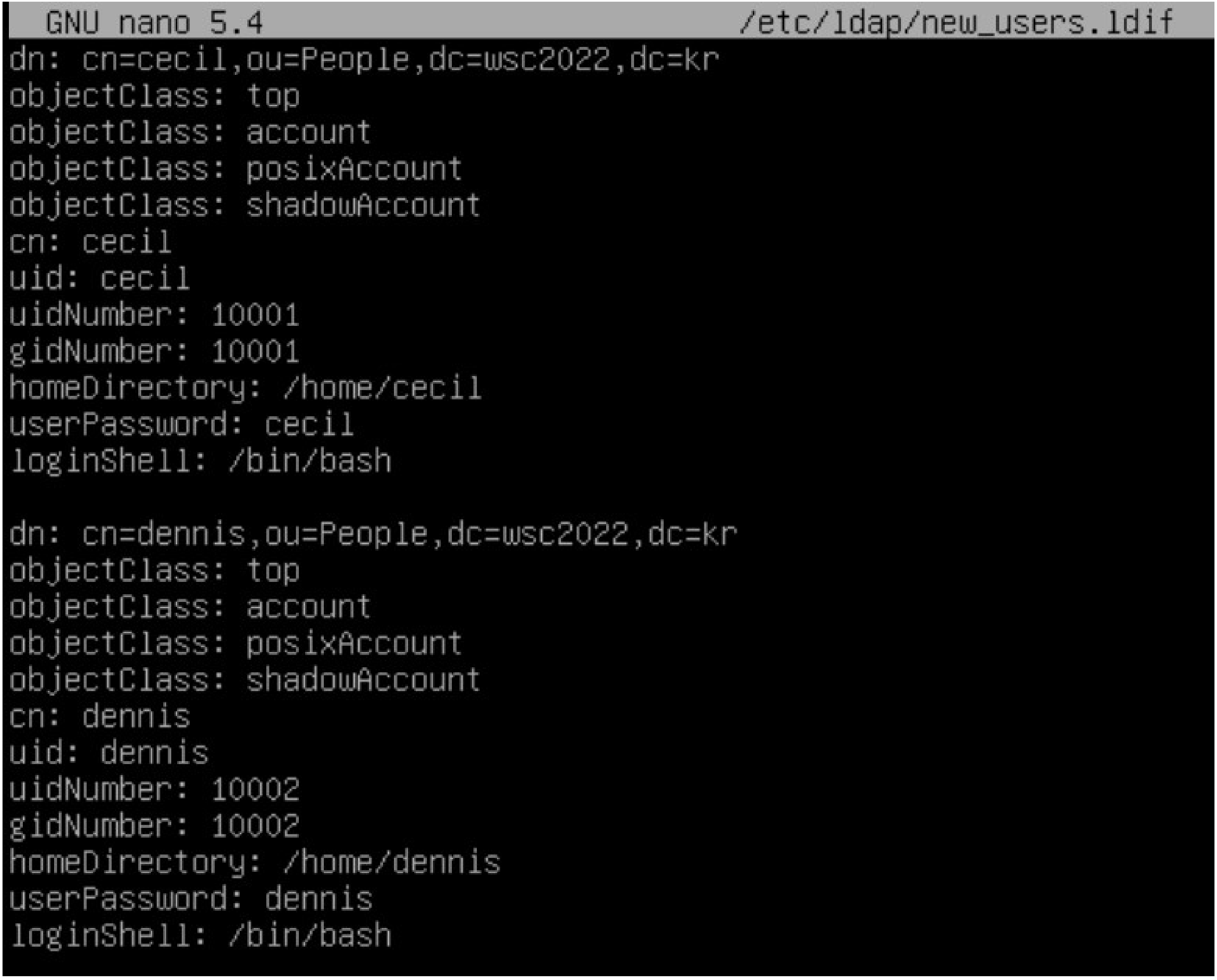
```
  GNU nano 5.4                         /etc/ldap/users.ldif
dn: ou=People,dc=wsc2022,dc=kr
objectClass: organizationalUnit
ou: People
```

-Add the new entry to the LDAP directory

ldapadd -D “cn=admin,dc=wsc2022,dc=kr” -W -H ldapi:/// -f /etc/ldap/users.ldif

-Add new users to LDAP by creating a new LDIF file in /etc/ldap/ and adding the following content

```
nano /etc/ldap/new_users.ldif
dn: cn=cecil,ou=People,dc=wsc2022,dc=kr
objectClass: top
objectClass: account
objectClass: posixAccount
objectClass: shadowAccount
cn: cecil
uid: cecil
uidNumber: 10001
gidNumber: 10001
homeDirectory: /home/cecil
userPassword: cecil
loginShell: /bin/bash
#Have an empty line between entries
dn: cn=dennis,ou=People,dc=wsc2022,dc=kr
objectClass: top
objectClass: account
objectClass: posixAccount
objectClass: shadowAccount
cn: dennis
uid: dennis
uidNumber: 10002
gidNumber: 10002
homeDirectory: /home/dennis
userPassword: dennis
loginShell: /bin/bash
```



```
  GNU nano 5.4                               /etc/ldap/new_users.ldif
dn: cn=cecil,ou=People,dc=wsc2022,dc=kr
objectClass: top
objectClass: account
objectClass: posixAccount
objectClass: shadowAccount
cn: cecil
uid: cecil
uidNumber: 10001
gidNumber: 10001
homeDirectory: /home/cecil
userPassword: cecil
loginShell: /bin/bash

dn: cn=dennis,ou=People,dc=wsc2022,dc=kr
objectClass: top
objectClass: account
objectClass: posixAccount
objectClass: shadowAccount
cn: dennis
uid: dennis
uidNumber: 10002
gidNumber: 10002
homeDirectory: /home/dennis
userPassword: dennis
loginShell: /bin/bash
```

-Add the new entries to the LDAP directory

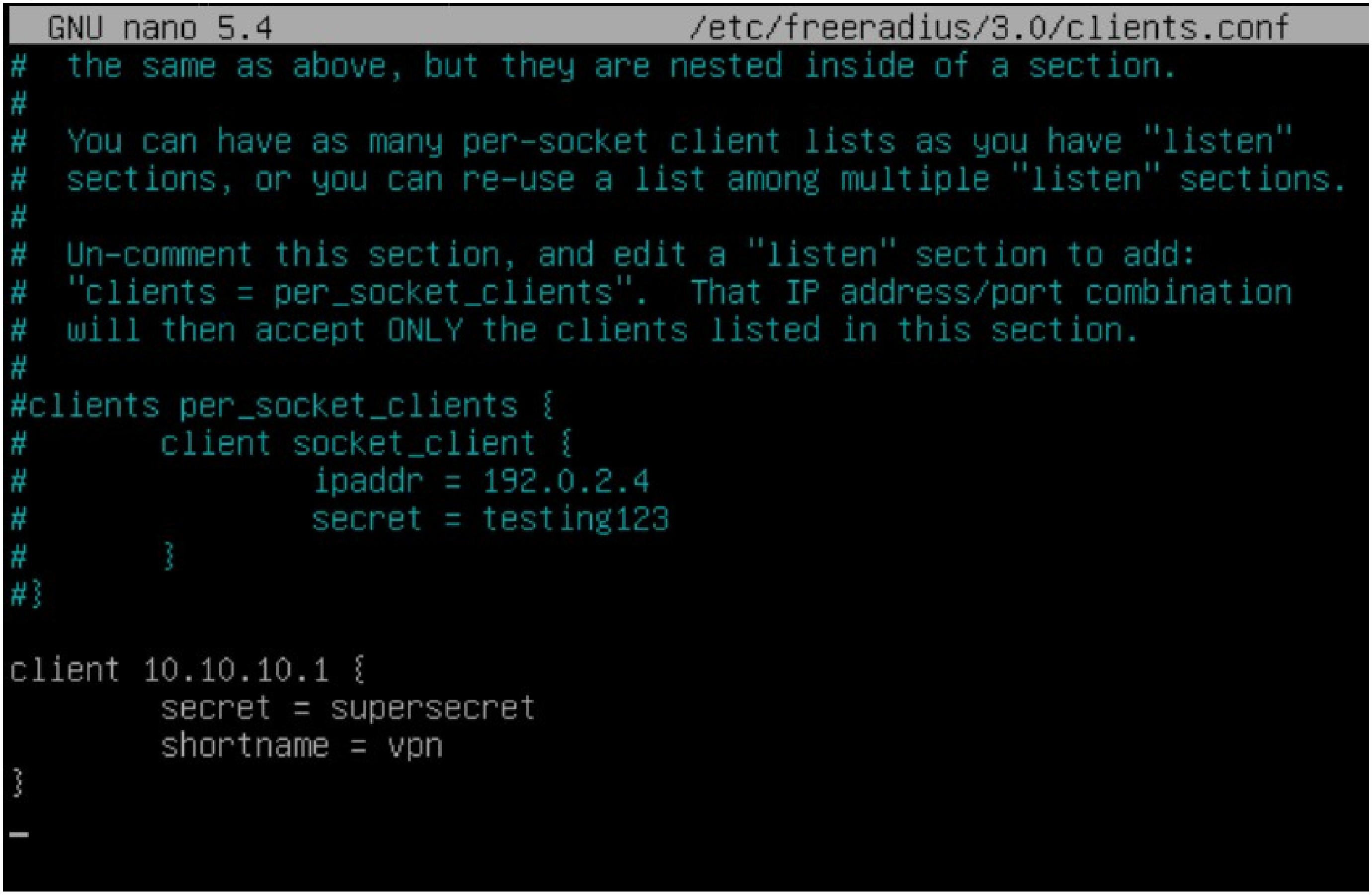
```
ldapadd -D "cn=admin,dc=wsc2022,dc=kr" -W -H ldapi:/// -f /etc/ldap/new_users.ldif
```

-Configure FreeRADIUS-

-Edit /etc/freeradius/3.0/clients.conf

-Define the VPN server as a RADIUS client at the end of the file

```
client 10.10.10.1 {
        secret = <random_secret>
        shortname = vpn
}
```

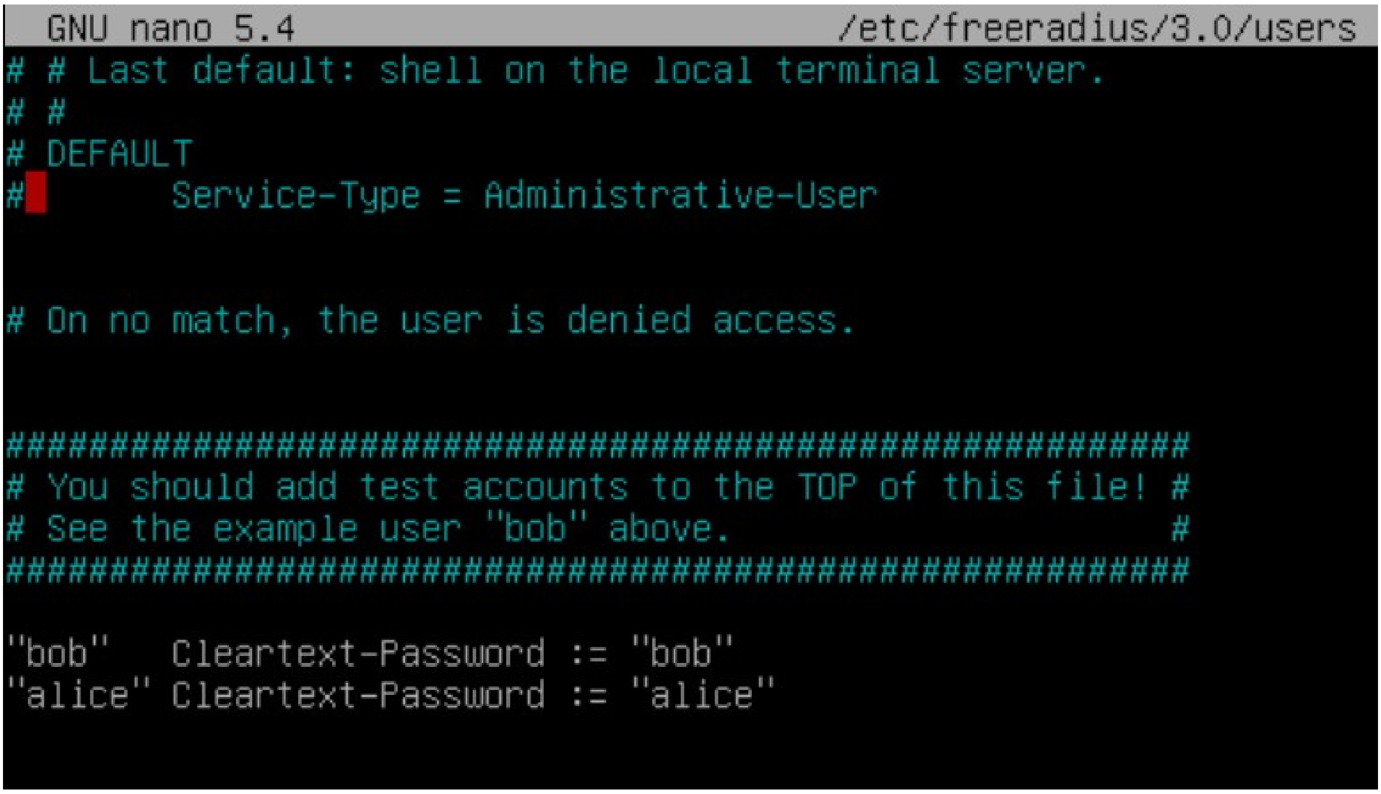


```
  GNU nano 5.4                         /etc/freeradius/3.0/clients.conf
#  the same as above, but they are nested inside of a section.
#
#  You can have as many per-socket client lists as you have "listen"
#  sections, or you can re-use a list among multiple "listen" sections.
#
#  Un-comment this section, and edit a "listen" section to add:
#  "clients = per_socket_clients".  That IP address/port combination
#  will then accept ONLY the clients listed in this section.
#
#clients per_socket_clients {
#       client socket_client {
#               ipaddr = 192.0.2.4
#               secret = testing123
#       }
#}

client 10.10.10.1 {
        secret = supersecret
        shortname = vpn
}
```

-Edit /etc/freeradius/3.0/users -> Only edit this file if you want to authenticate with RADIUS only. If you want to authenticate with LDAP just skip this step.

-Define the users that can authenticate

```
"<username>"    Cleartext-Password := "<userpassword>"
```

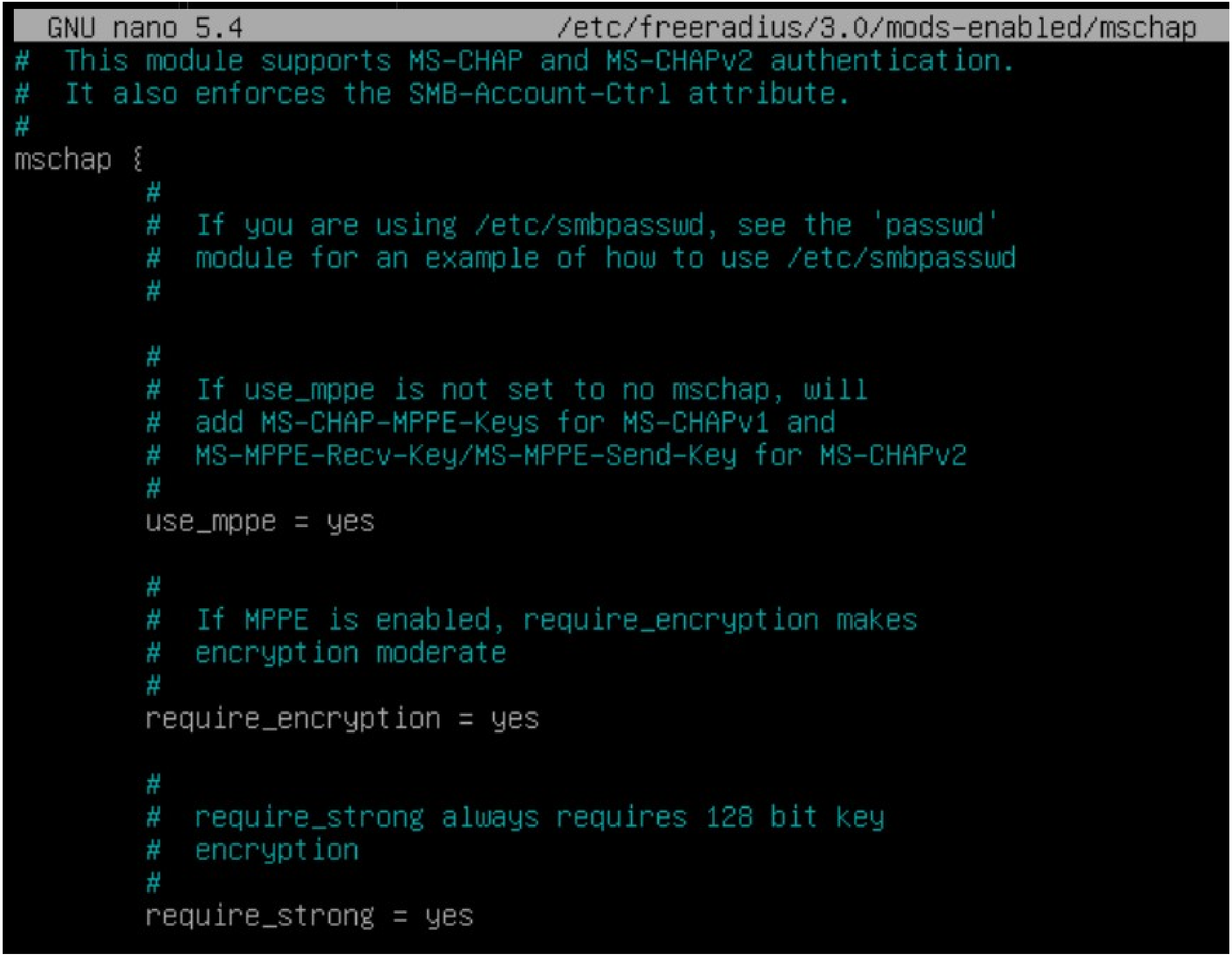


```
  GNU nano 5.4                          /etc/freeradius/3.0/users
# # Last default: shell on the local terminal server.
# #
# DEFAULT
#       Service-Type = Administrative-User


# On no match, the user is denied access.


#########################################################
# You should add test accounts to the TOP of this file! #
# See the example user "bob" above.                     #
#########################################################

"bob"   Cleartext-Password := "bob"
"alice" Cleartext-Password := "alice"
```

-Edit /etc/freeradius/3.0/mods-enabled/mschap

-Uncomment the following lines and change their values to “yes”

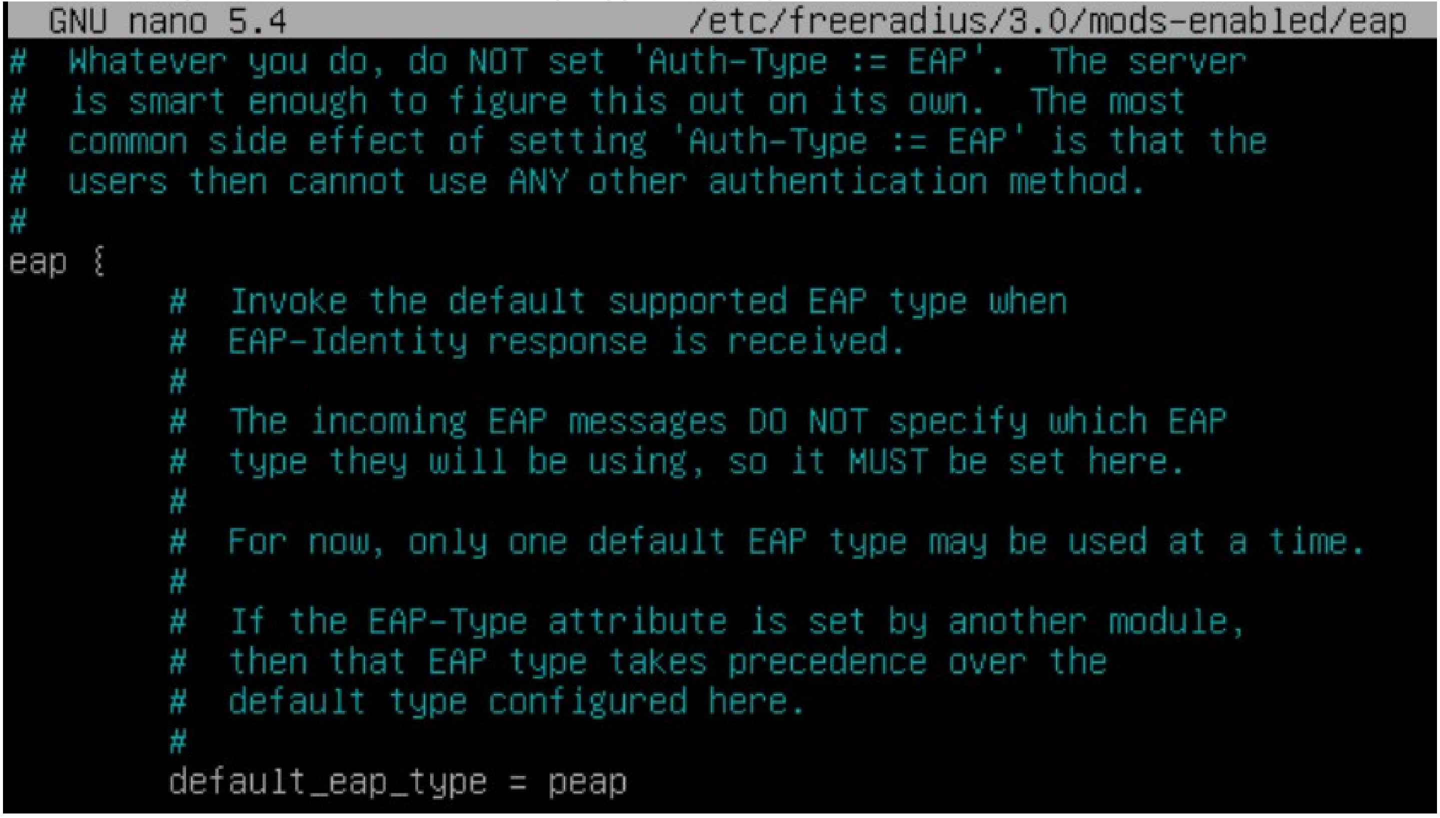
use_mppe = yes
require_encryption = yes
require_strong = yes



```
  GNU nano 5.4                 /etc/freeradius/3.0/mods-enabled/mschap
#  This module supports MS-CHAP and MS-CHAPv2 authentication.
#  It also enforces the SMB-Account-Ctrl attribute.
#
mschap {
        #
        #  If you are using /etc/smbpasswd, see the 'passwd'
        #  module for an example of how to use /etc/smbpasswd
        #

        #
        #  If use_mppe is not set to no mschap, will
        #  add MS-CHAP-MPPE-Keys for MS-CHAPv1 and
        #  MS-MPPE-Recv-Key/MS-MPPE-Send-Key for MS-CHAPv2
        #
        use_mppe = yes

        #
        #  If MPPE is enabled, require_encryption makes
        #  encryption moderate
        #
        require_encryption = yes

        #
        #  require_strong always requires 128 bit key
        #  encryption
        #
        require_strong = yes
```

-Edit /etc/freeradius/3.0/mods-enabled/eap

-In the eap module set default_eap_type to peap



```
  GNU nano 5.4                          /etc/freeradius/3.0/mods-enabled/eap
#  Whatever you do, do NOT set 'Auth-Type := EAP'.  The server
#  is smart enough to figure this out on its own.  The most
#  common side effect of setting 'Auth-Type := EAP' is that the
#  users then cannot use ANY other authentication method.
#
eap {
        #  Invoke the default supported EAP type when
        #  EAP-Identity response is received.
        #
        #  The incoming EAP messages DO NOT specify which EAP
        #  type they will be using, so it MUST be set here.
        #
        #  For now, only one default EAP type may be used at a time.
        #
        #  If the EAP-Type attribute is set by another module,
        #  then that EAP type takes precedence over the
        #  default type configured here.
        #
        default_eap_type = peap
```

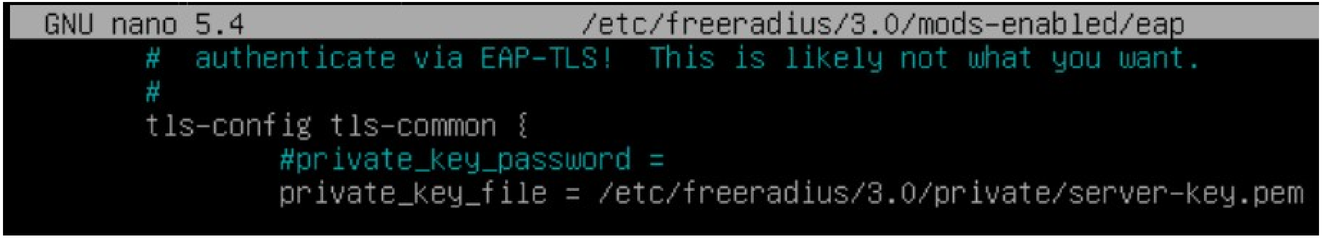
-In the tls-config tls-common module

-comment the private_key_password line if you don't need a password for the private key

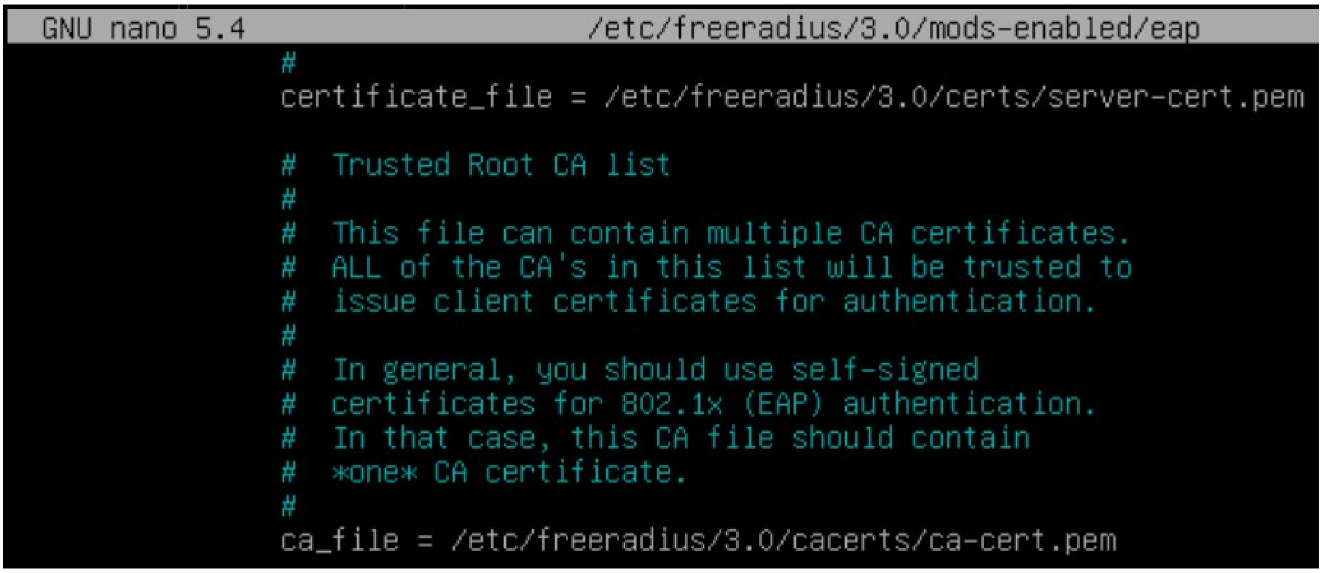
-set the private_key_file, certificate_file and ca_file

-uncomment this line: random = /dev/urandom

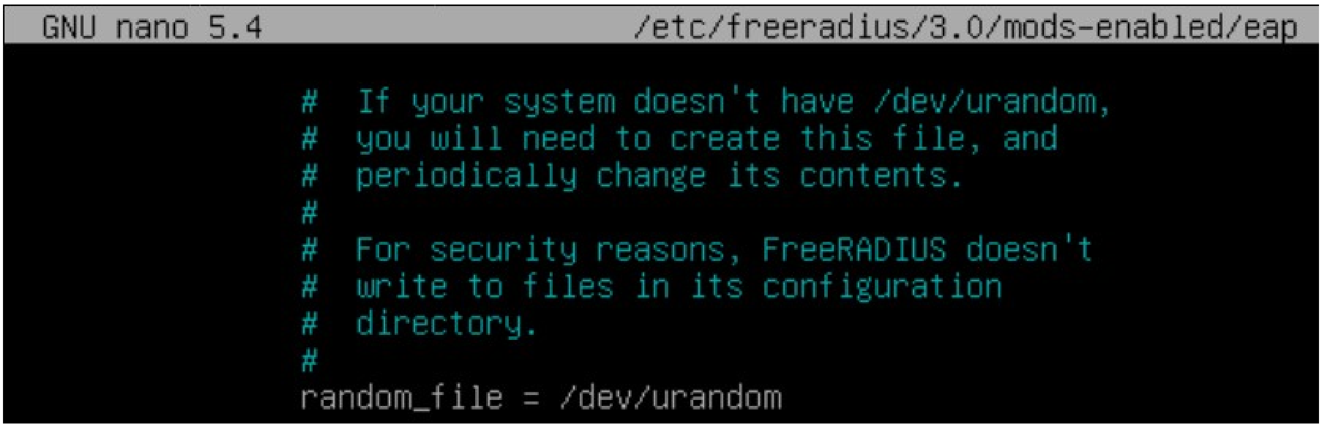
private_key_file = /etc/freeradius/3.0/private/server-key.pem
certificate_file = /etc/freeradius/3.0/certs/server-cert.pem
ca_file = /etc/freeradius/3.0/cacerts/ca-cert.pem



```
  GNU nano 5.4                          /etc/freeradius/3.0/mods-enabled/eap
        #  authenticate via EAP-TLS!  This is likely not what you want.
        #
        tls-config tls-common {
                #private_key_password =
                private_key_file = /etc/freeradius/3.0/private/server-key.pem
```

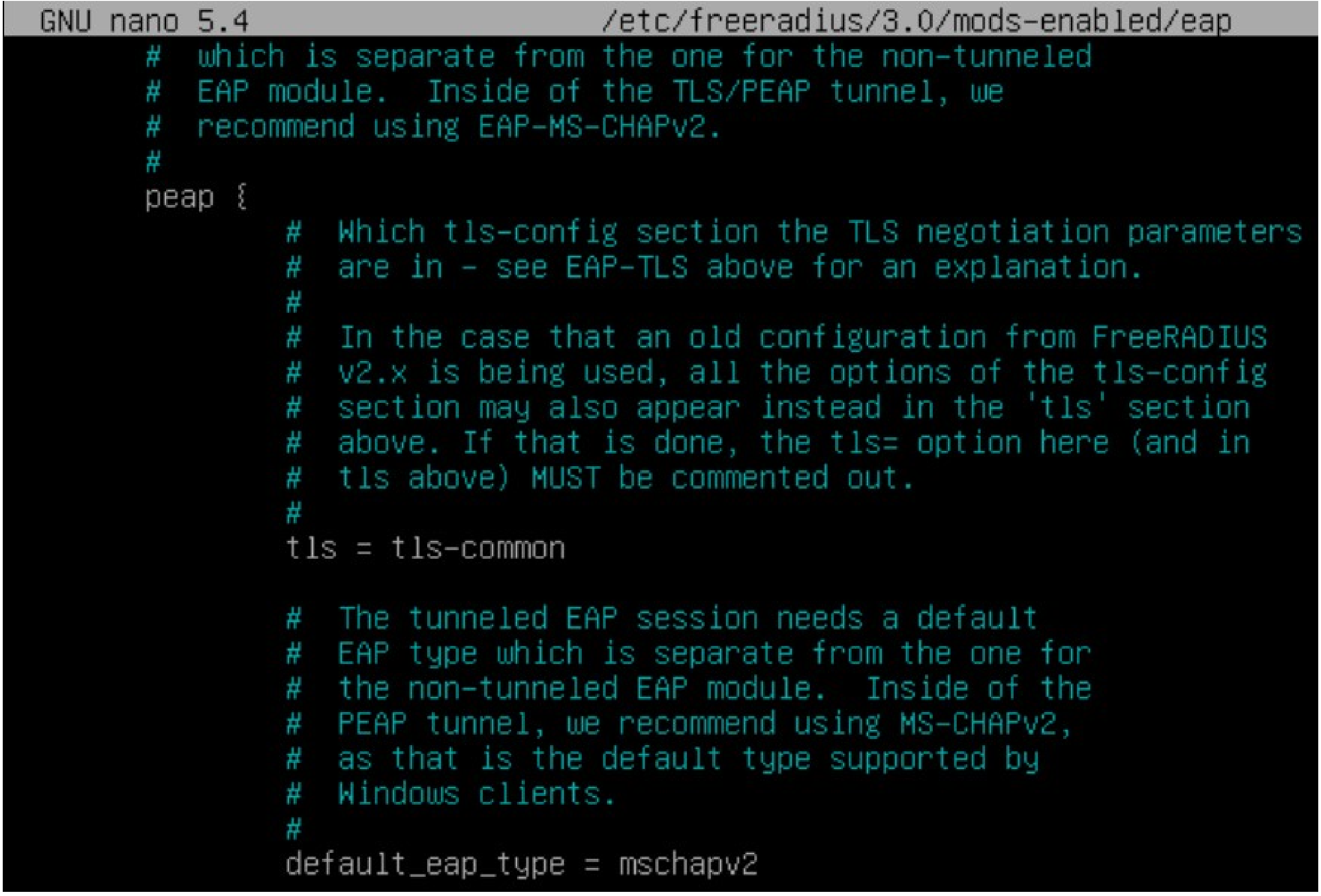


```
  GNU nano 5.4                          /etc/freeradius/3.0/mods-enabled/eap
                #
                certificate_file = /etc/freeradius/3.0/certs/server-cert.pem

                #  Trusted Root CA list
                #
                #  This file can contain multiple CA certificates.
                #  ALL of the CA's in this list will be trusted to
                #  issue client certificates for authentication.
                #
                #  In general, you should use self-signed
                #  certificates for 802.1x (EAP) authentication.
                #  In that case, this CA file should contain
                #  *one* CA certificate.
                #
                ca_file = /etc/freeradius/3.0/cacerts/ca-cert.pem
```



```
 GNU nano 5.4                           /etc/freeradius/3.0/mods-enabled/eap

                     #  If your system doesn't have /dev/urandom,
                     #  you will need to create this file, and
                     #  periodically change its contents.
                     #
                     #  For security reasons, FreeRADIUS doesn't
                     #  write to files in its configuration
                     #  directory.
                     #
                     random_file = /dev/urandom
```

-In the peap module set the default_eap_type to mschapv2 #This should be the default option just make sure it is

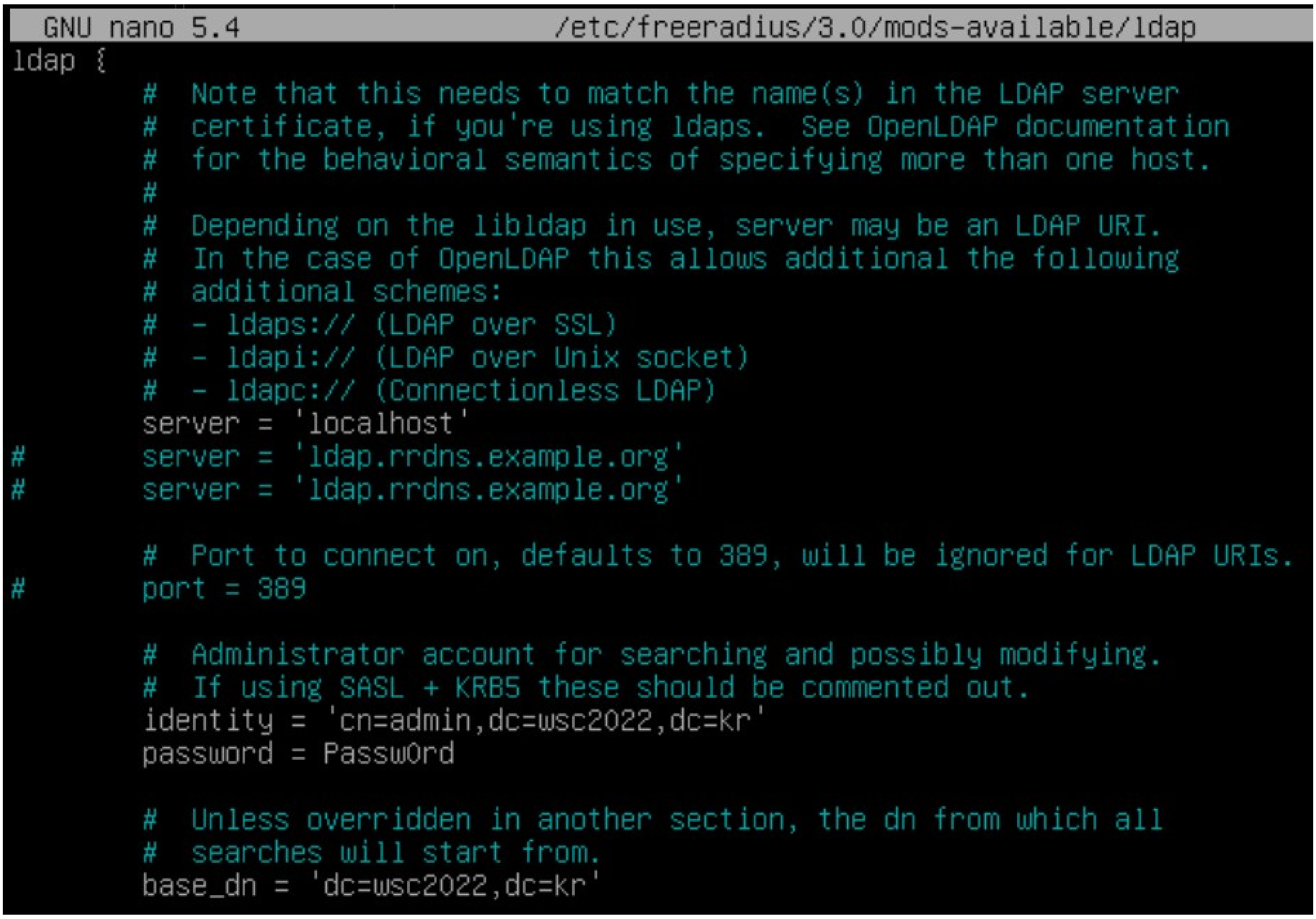


```
 GNU nano 5.4                           /etc/freeradius/3.0/mods-enabled/eap
        #  which is separate from the one for the non-tunneled
        #  EAP module.  Inside of the TLS/PEAP tunnel, we
        #  recommend using EAP-MS-CHAPv2.
        #
        peap {
                #  Which tls-config section the TLS negotiation parameters
                #  are in - see EAP-TLS above for an explanation.
                #
                #  In the case that an old configuration from FreeRADIUS
                #  v2.x is being used, all the options of the tls-config
                #  section may also appear instead in the 'tls' section
                #  above. If that is done, the tls= option here (and in
                #  tls above) MUST be commented out.
                #
                tls = tls-common

                #  The tunneled EAP session needs a default
                #  EAP type which is separate from the one for
                #  the non-tunneled EAP module.  Inside of the
                #  PEAP tunnel, we recommend using MS-CHAPv2,
                #  as that is the default type supported by
                #  Windows clients.
                #
                default_eap_type = mschapv2
```

-Edit /etc/freeradius/3.0/mods-available/ldap

-Edit the following lines in the ldap module

server = ‘localhost’ #Only edit this if the LDAP service is on a different server
identity = 'cn=admin,dc=wsc2022,dc=kr'
password = ‘Passw0rd’ #LDAP admin password
base_dn = ‘dc=wsc2022,dc=kr’



```
  GNU nano 5.4                    /etc/freeradius/3.0/mods-available/ldap
ldap {
        #  Note that this needs to match the name(s) in the LDAP server
        #  certificate, if you're using ldaps.  See OpenLDAP documentation
        #  for the behavioral semantics of specifying more than one host.
        #
        #  Depending on the libldap in use, server may be an LDAP URI.
        #  In the case of OpenLDAP this allows additional the following
        #  additional schemes:
        #  - ldaps:// (LDAP over SSL)
        #  - ldapi:// (LDAP over Unix socket)
        #  - ldapc:// (Connectionless LDAP)
        server = 'localhost'
#       server = 'ldap.rrdns.example.org'
#       server = 'ldap.rrdns.example.org'

        #  Port to connect on, defaults to 389, will be ignored for LDAP URIs.
#       port = 389

        #  Administrator account for searching and possibly modifying.
        #  If using SASL + KRB5 these should be commented out.
        identity = 'cn=admin,dc=wsc2022,dc=kr'
        password = Passw0rd

        #  Unless overridden in another section, the dn from which all
        #  searches will start from.
        base_dn = 'dc=wsc2022,dc=kr'
```

-Copy /etc/freeradius/3.0/mods-available/ldap to /etc/freeradius/3.0/mods-enabled/ldap and set the correct permissions

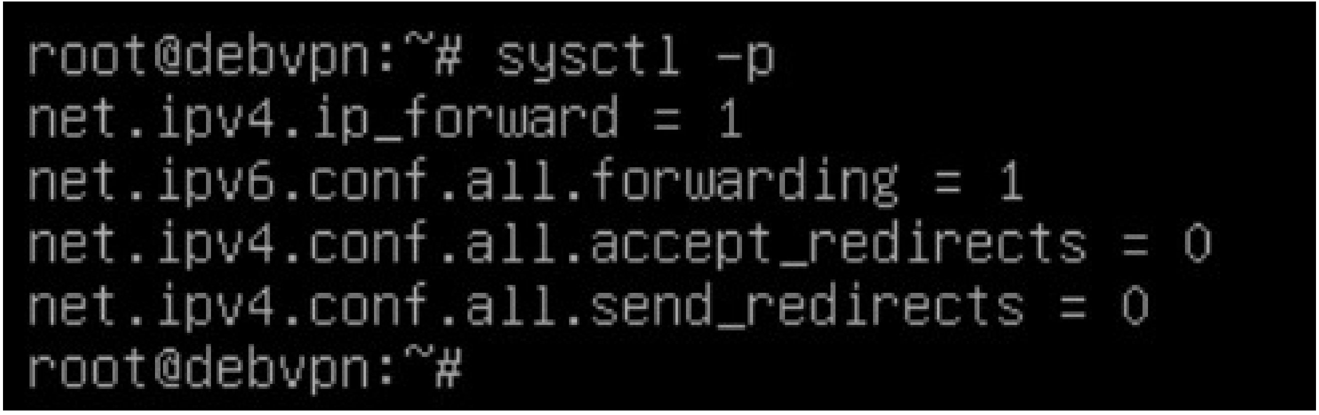
```
cp /etc/freeradius/3.0/mods-available/ldap /etc/freeradius/3.0/mods-enabled/ldap
chown freerad:freerad /etc/freeradius/3.0/mods-enabled/ldap
chmod 775 /etc/freeradius/3.0/mods-enabled/ldap
```

-Enable packet forwarding in /etc/sysctl.conf

-Uncomment the following lines

```
net.ipv4.ip_forward = 1
net.ipv6.conf.all.forwarding = 1
net.ipv4.conf.all.accept.redirects = 0
net.ipv4.conf.all.send.redirects = 0
```

-Enable the changes with: sysctl -p



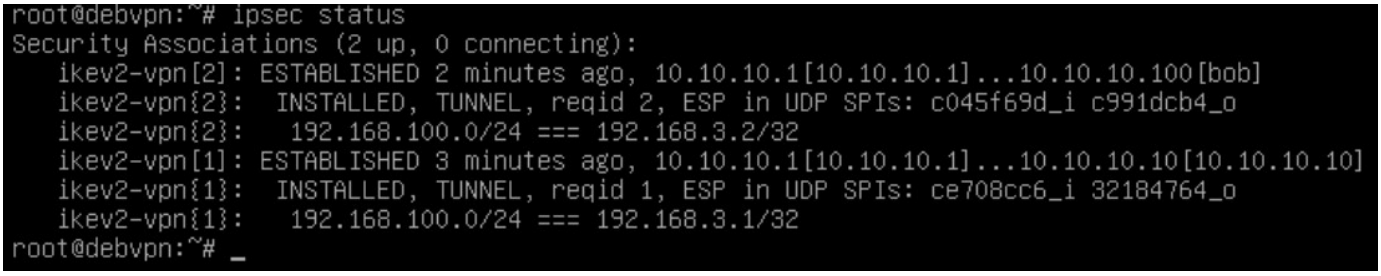
```
root@debvpn:~# sysctl -p
net.ipv4.ip_forward = 1
net.ipv6.conf.all.forwarding = 1
net.ipv4.conf.all.accept_redirects = 0
net.ipv4.conf.all.send_redirects = 0
root@debvpn:~#
```

-Restart the strongswan and freeradius

```
systemctl restart freeradius
systemctl restart strongswan-starter
```

-To check active connections

```
ipsec status
```



```
root@debvpn:~# ipsec status
Security Associations (2 up, 0 connecting):
   ikev2-vpn[2]: ESTABLISHED 2 minutes ago, 10.10.10.1[10.10.10.1]...10.10.10.100[bob]
   ikev2-vpn{2}:  INSTALLED, TUNNEL, reqid 2, ESP in UDP SPIs: c045f69d_i c991dcb4_o
   ikev2-vpn{2}:   192.168.100.0/24 === 192.168.3.2/32
   ikev2-vpn[1]: ESTABLISHED 3 minutes ago, 10.10.10.1[10.10.10.1]...10.10.10.10[10.10.10.10]
   ikev2-vpn{1}:  INSTALLED, TUNNEL, reqid 1, ESP in UDP SPIs: ce708cc6_i 32184764_o
   ikev2-vpn{1}:   192.168.100.0/24 === 192.168.3.1/32
root@debvpn:~# _
```

-Configuring the Debian client-

-Install strongswan on the client aswell

    apt install strongswan libcharon-extra-plugins

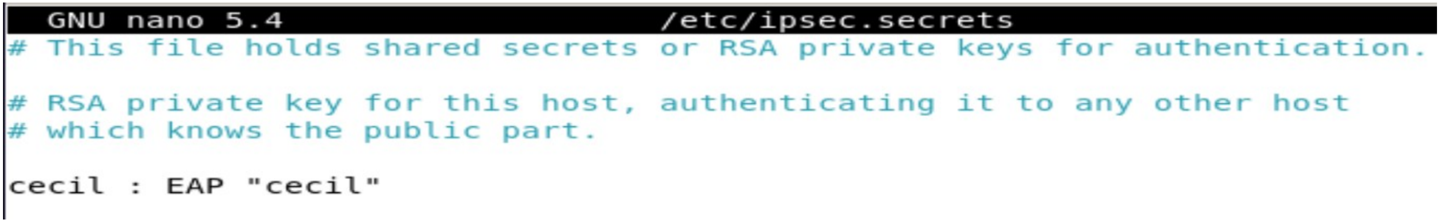
-Copy the CA certificate from the server to /etc/ipsec.d/cacerts

-To ensure the VPN only runs on demand, disable it from running automatically

    systemctl disable –now strongswan-starter

-Edit the /etc/ipsec.secrets file

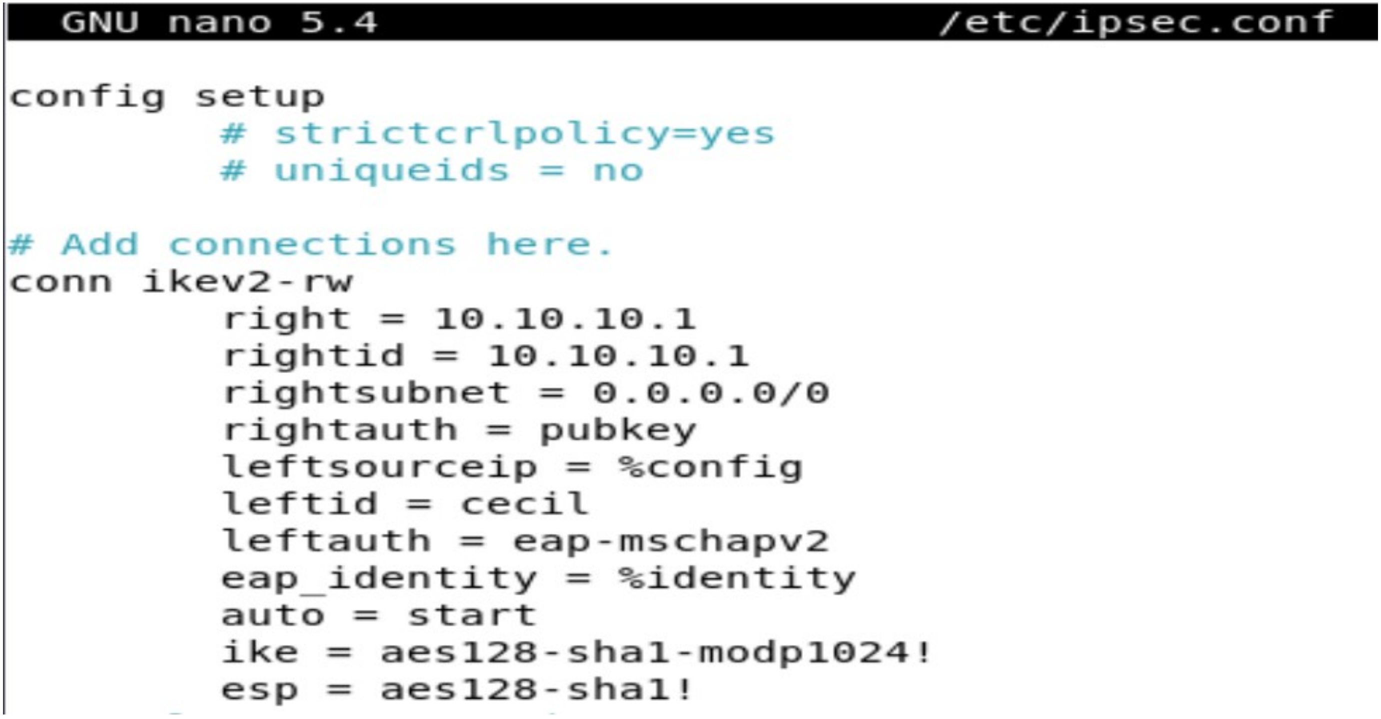
    <username> : EAP "<password>"



```
  GNU nano 5.4                    /etc/ipsec.secrets
# This file holds shared secrets or RSA private keys for authentication.

# RSA private key for this host, authenticating it to any other host
# which knows the public part.

cecil : EAP "cecil"
```

-Edit the /etc/ipsec.conf

```
conn ikev2-rw
        right = 10.10.10.1 #You can use domain name
        rightid = 10.10.10.1 #You can use domain name
        rightsubnet = 0.0.0.0/0
        rightauth = pubkey
        leftsourceip = %config
        leftid = <username> #Enter a username from /etc/ipsec.secrets
        leftauth = eap-mschapv2
        eap_identity = %identity
        auto = start
        ike = aes128-sha1-modp1024! #Needs to be same as it's on the server
        esp = aes128-sha1! #Needs to be the same as it's on the server
```



```
  GNU nano 5.4                    /etc/ipsec.conf

config setup
        # strictcrlpolicy=yes
        # uniqueids = no

# Add connections here.
conn ikev2-rw
        right = 10.10.10.1
        rightid = 10.10.10.1
        rightsubnet = 0.0.0.0/0
        rightauth = pubkey
        leftsourceip = %config
        leftid = cecil
        leftauth = eap-mschapv2
        eap_identity = %identity
        auto = start
        ike = aes128-sha1-modp1024!
        esp = aes128-sha1!
```

-To connect to the VPN

```
systemctl start strongswan-starter
```

-To disconnect

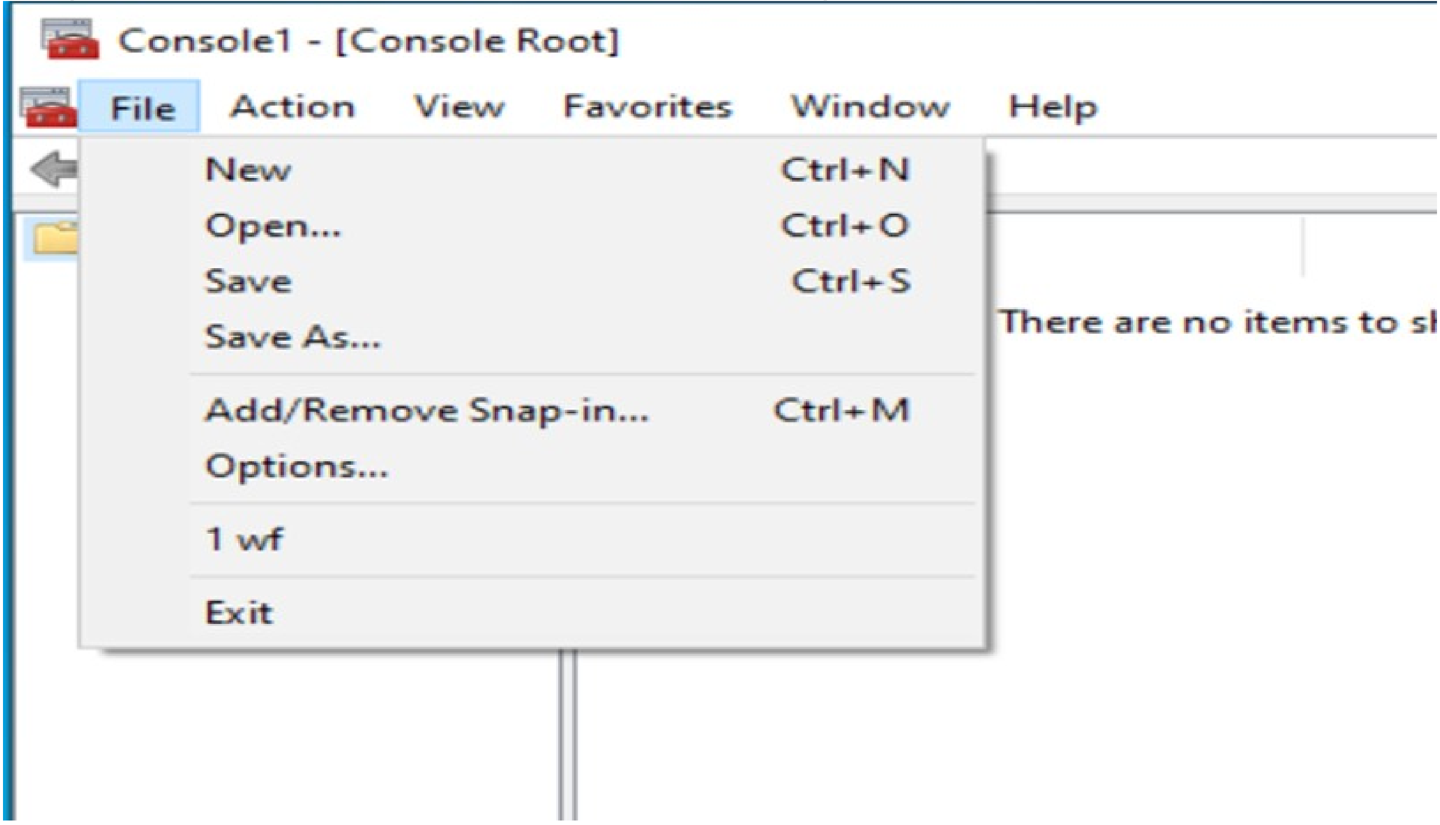
```
systemctl stop strongswan-starter
```

-Configuring the Windows client-

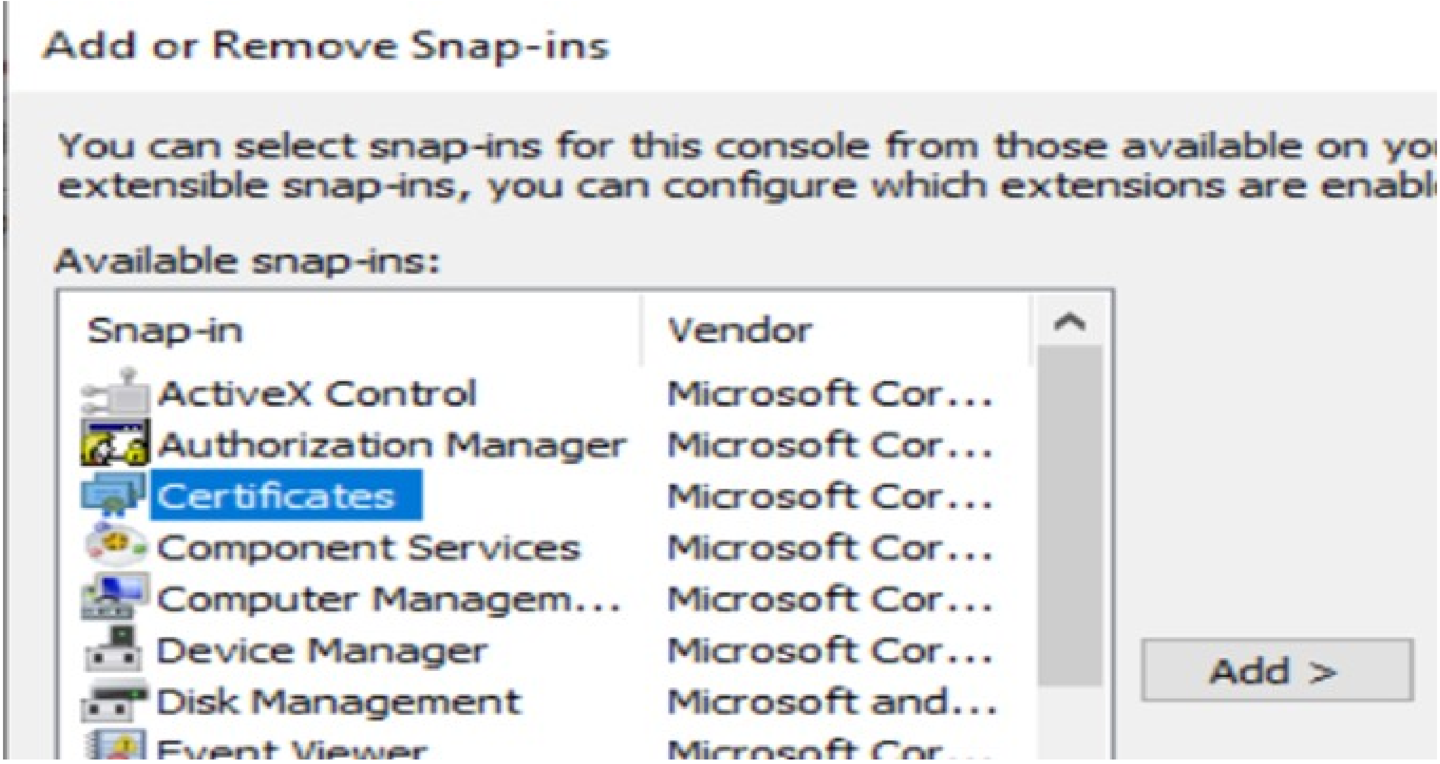
-Copy the CA certificate from the server

-Import the root cert

-Open mmc.exe -> click on File > Add/Remove Snap-in...



-Add the Certificates snap-in



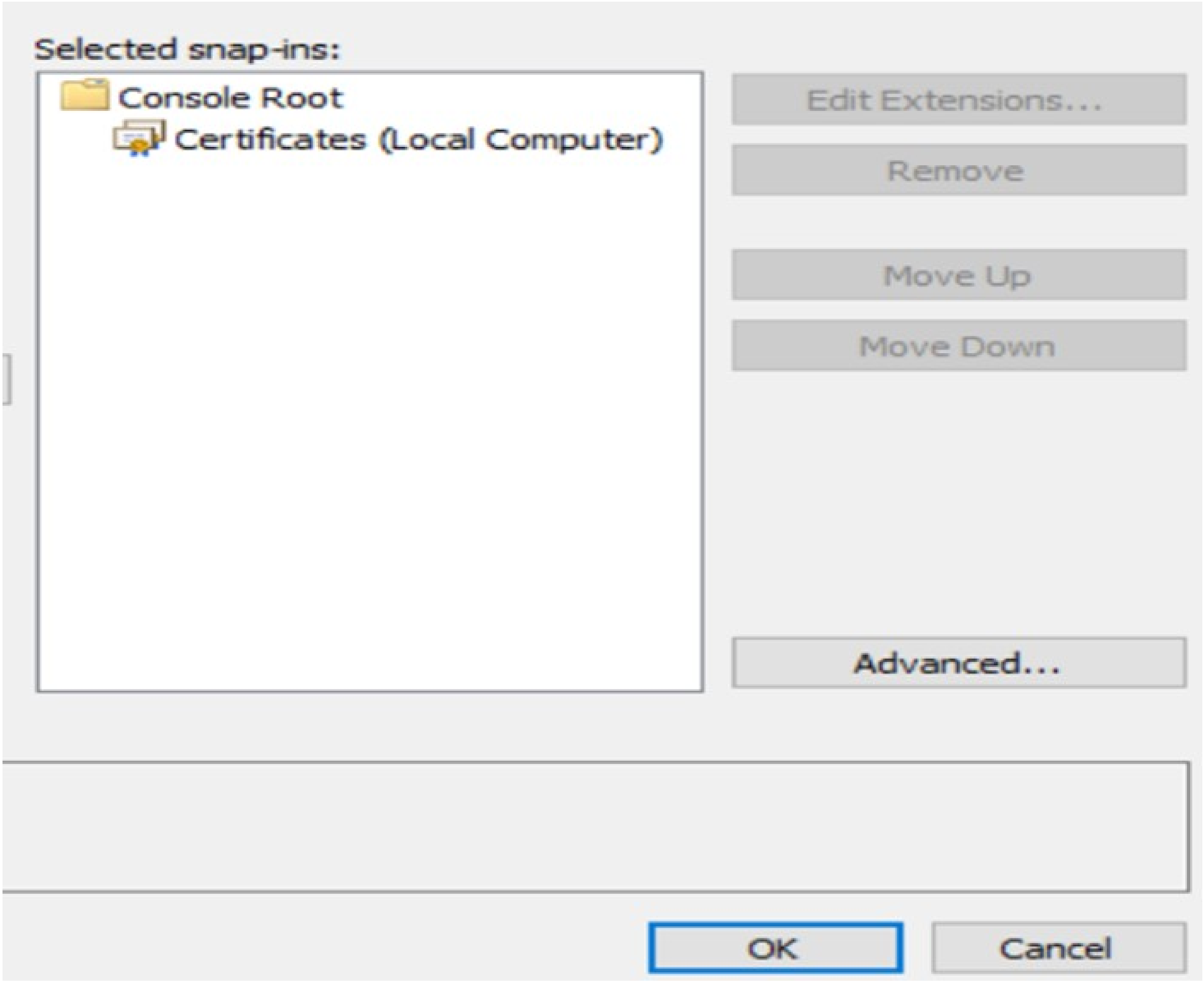
Add or Remove Snap-ins

You can select snap-ins for this console from those available on yo extensible snap-ins, you can configure which extensions are enabl

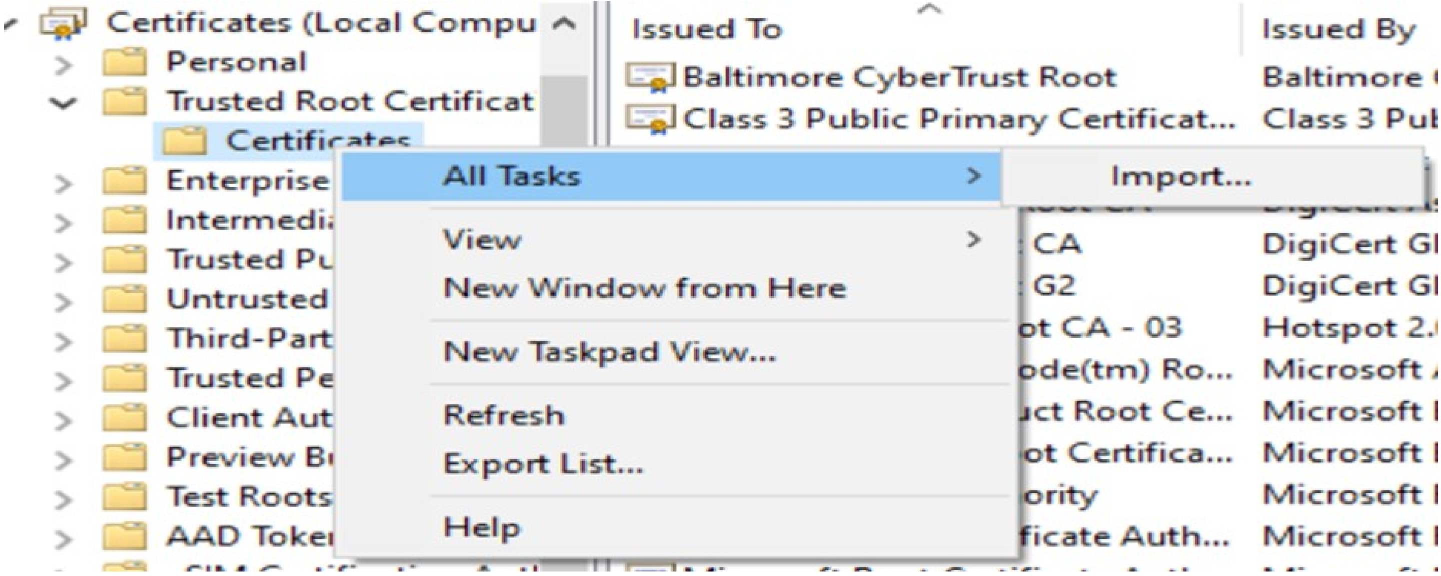
Available snap-ins:

Snap-in	Vendor
ActiveX Control	Microsoft Cor...
Authorization Manager	Microsoft Cor...
Certificates	Microsoft Cor...
Component Services	Microsoft Cor...
Computer Managem...	Microsoft Cor...
Device Manager	Microsoft Cor...
Disk Management	Microsoft and...
Event Viewer	Microsoft Cor...

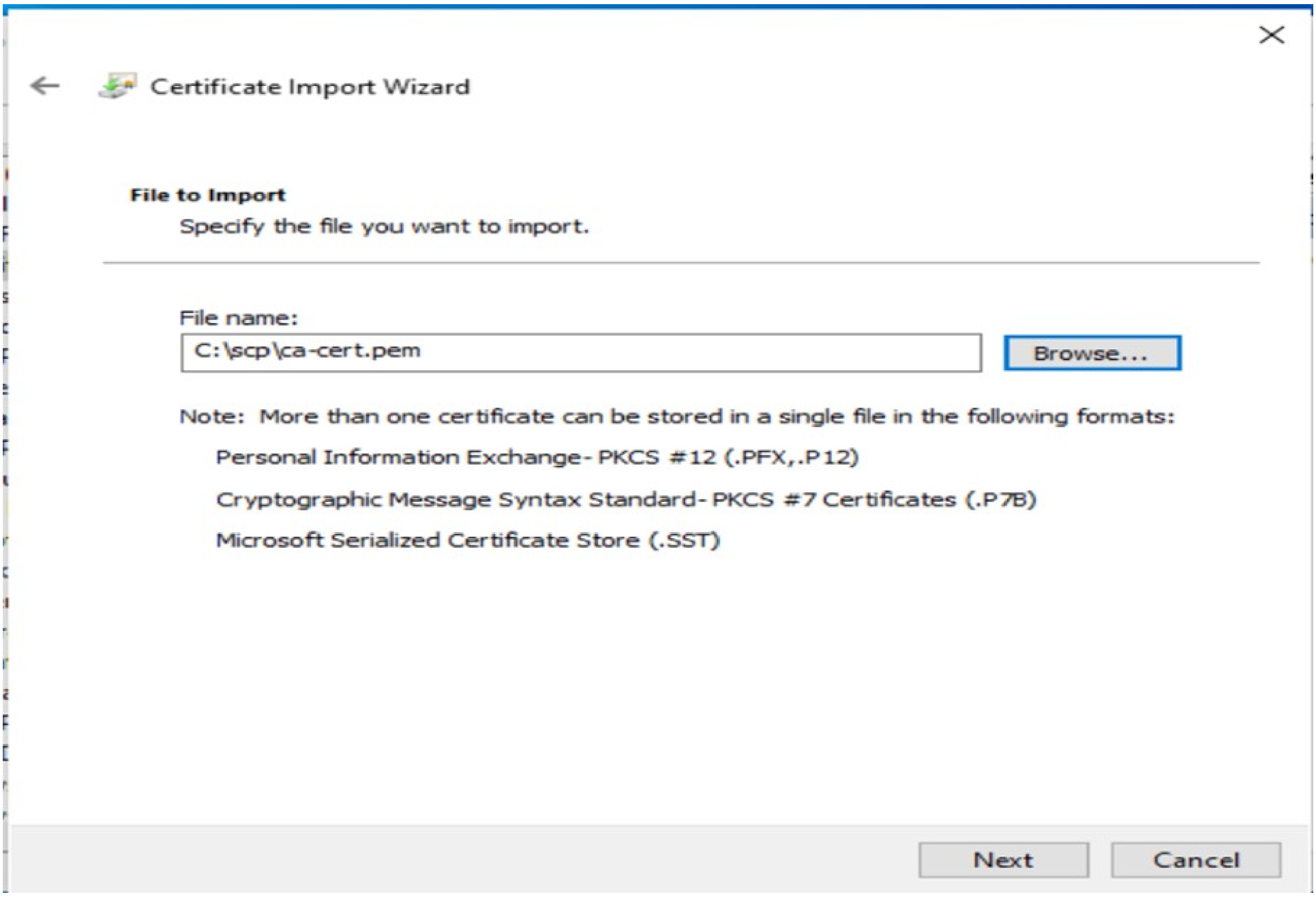
-Select Computer Account, then Local Computer, then OK



-Open Trusted Root Certification Authorities and right click on Certificates, then click on All tasks > Import



-Specify the cert you copied over


Certificate Import Wizard

File to Import

Specify the file you want to import.

File name:

C:\scp\ca-cert.pem

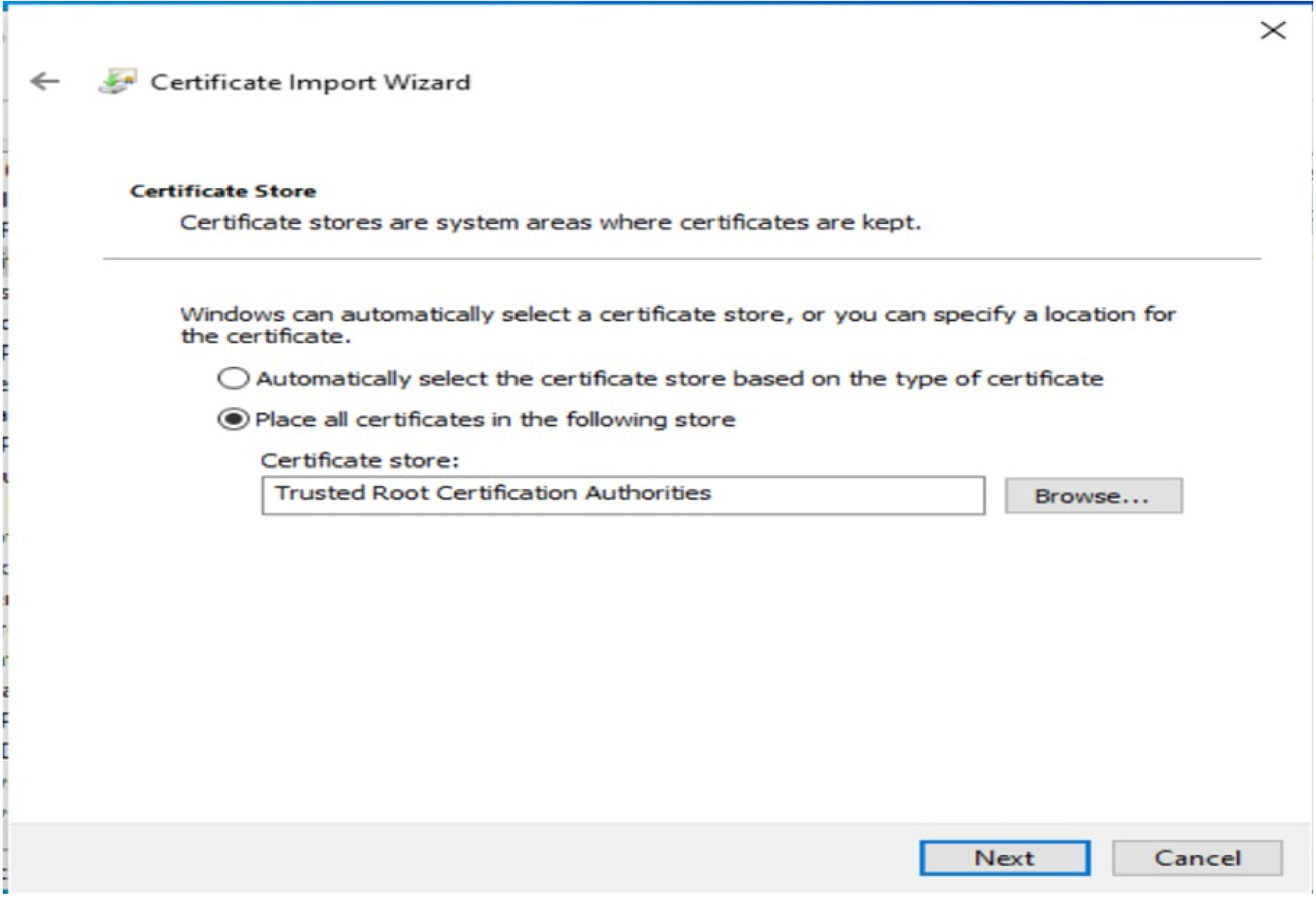
Note: More than one certificate can be stored in a single file in the following formats:

Personal Information Exchange- PKCS #12 (.PFX,.P12)

Cryptographic Message Syntax Standard- PKCS #7 Certificates (.P7B)

Microsoft Serialized Certificate Store (.SST)

-Make sure it goes to the Trusted Root Certification Authorities


Certificate Import Wizard

Certificate Store

Certificate stores are system areas where certificates are kept.

Windows can automatically select a certificate store, or you can specify a location for the certificate.

○ Automatically select the certificate store based on the type of certificate

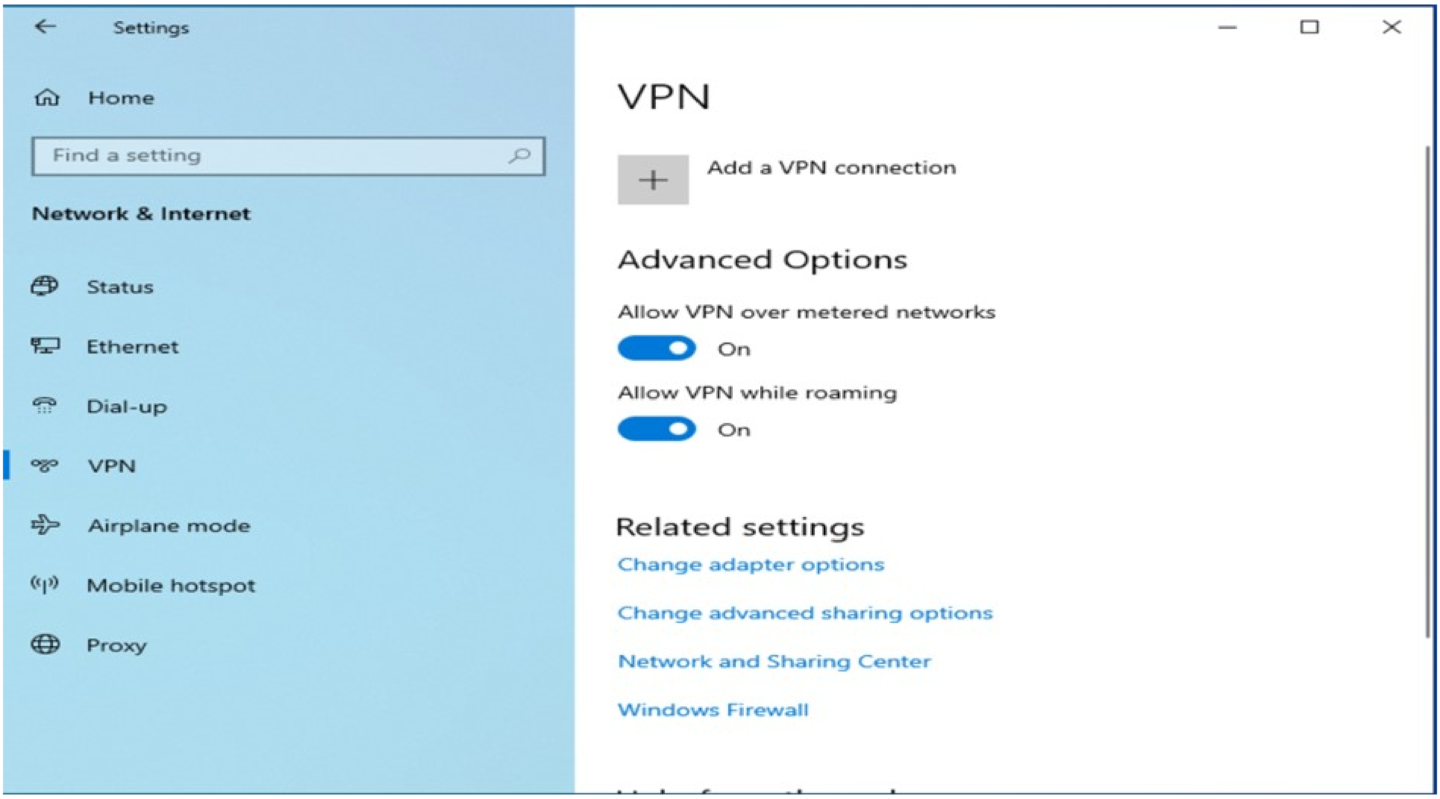
● Place all certificates in the following store

Certificate store:

Trusted Root Certification Authorities

-Add a new VPN connection

-Go to Settings > VPN > Add a VPN connection



VPN

+ Add a VPN connection

Advanced Options

Allow VPN over metered networks
On

Allow VPN while roaming
On

Related settings

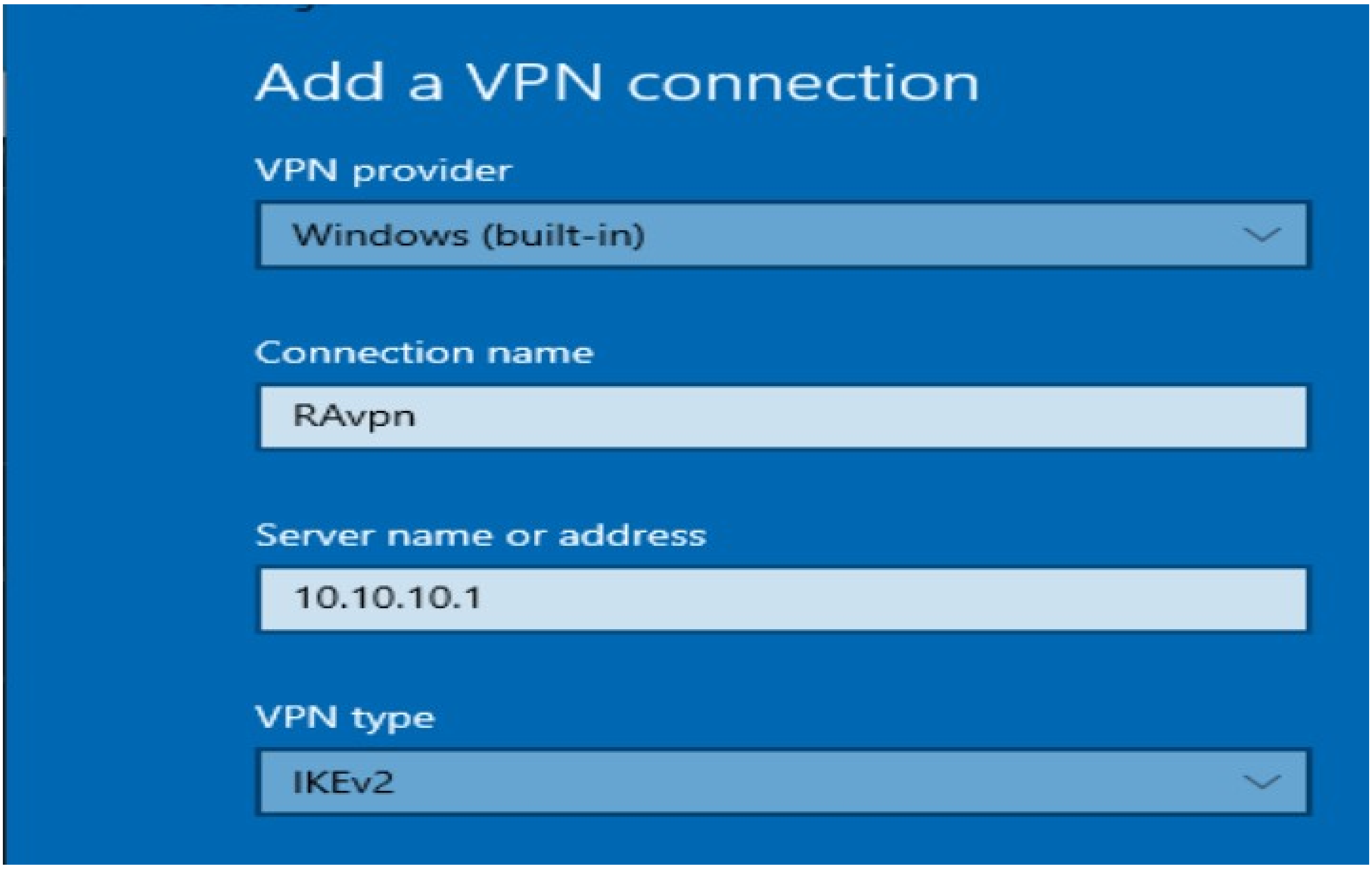
Change adapter options

Change advanced sharing options

Network and Sharing Center

Windows Firewall

-Fill out the fields



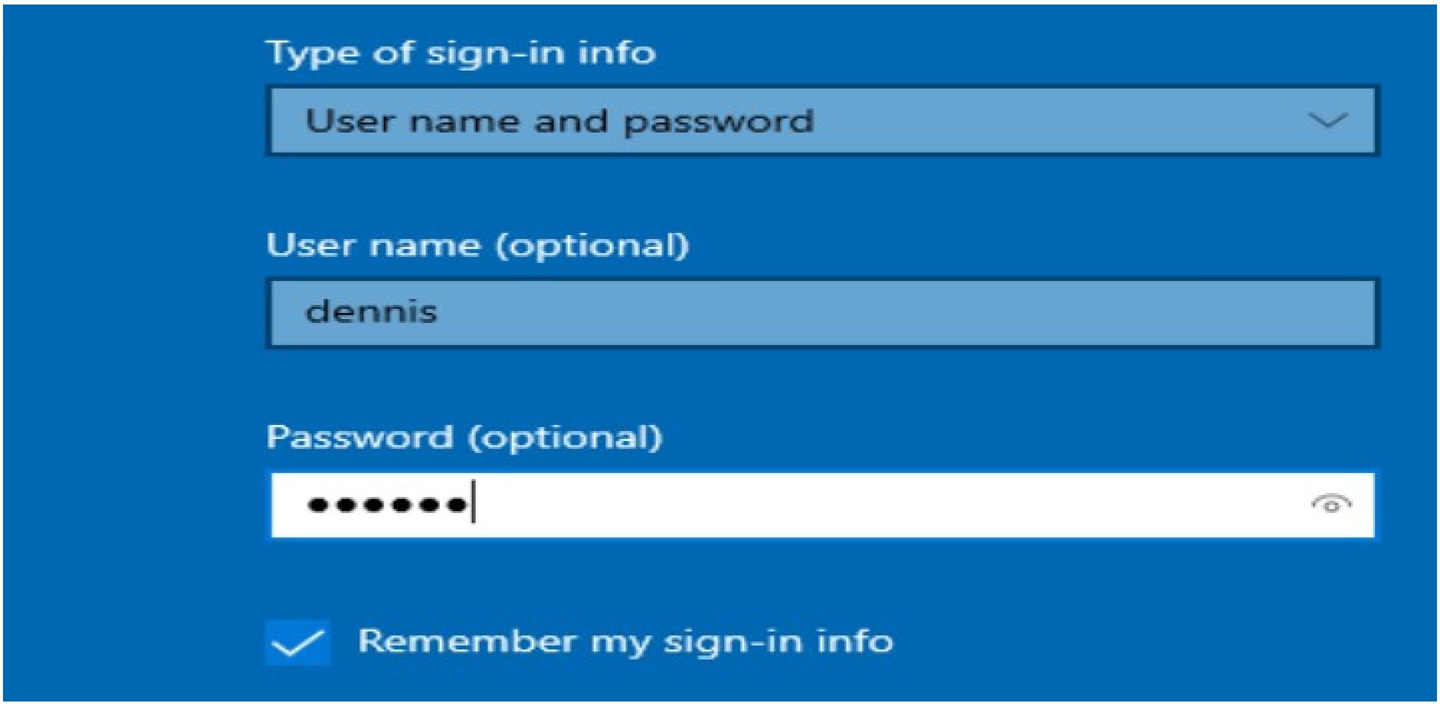
Add a VPN connection

VPN provider
Windows (built-in)

Connection name
RAvpn

Server name or address
10.10.10.1

VPN type
IKEv2



Type of sign-in info

User name and password

User name (optional)

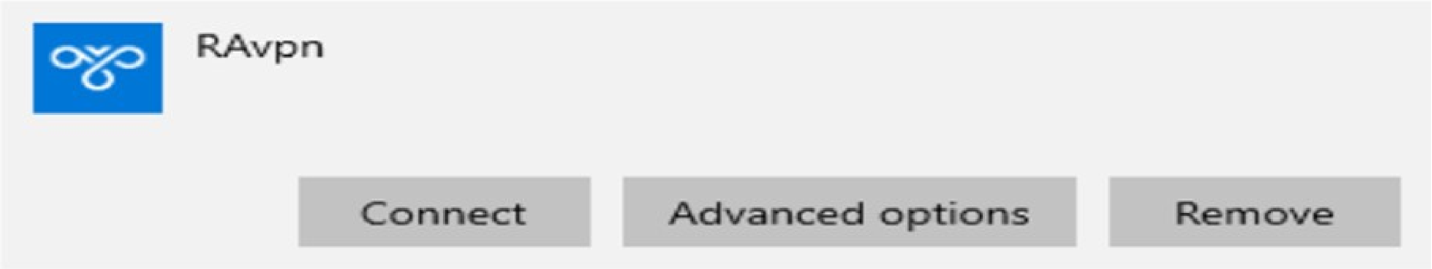
dennis

Password (optional)

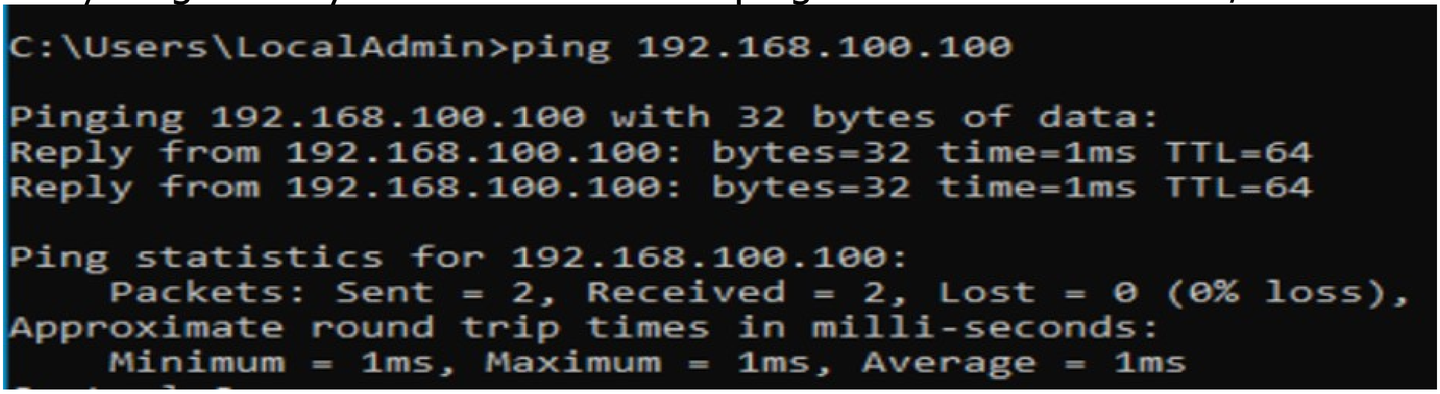
••••••

☑ Remember my sign-in info

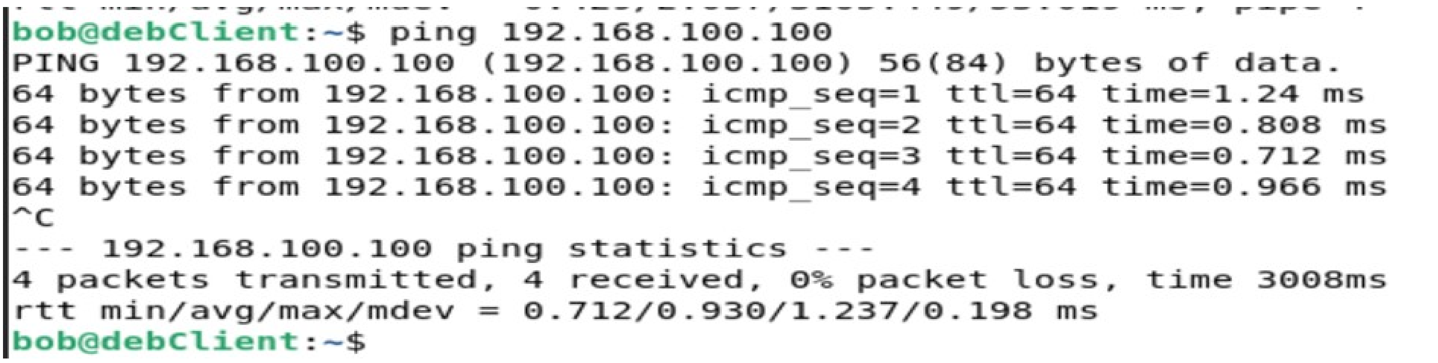
-Click on connect on the new VPN connection



-If everything works you should be able to ping stuff in 192.168.100.0/24



```
C:\Users\LocalAdmin>ping 192.168.100.100

Pinging 192.168.100.100 with 32 bytes of data:
Reply from 192.168.100.100: bytes=32 time=1ms TTL=64
Reply from 192.168.100.100: bytes=32 time=1ms TTL=64

Ping statistics for 192.168.100.100:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```



```
bob@debClient:~$ ping 192.168.100.100
PING 192.168.100.100 (192.168.100.100) 56(84) bytes of data.
64 bytes from 192.168.100.100: icmp_seq=1 ttl=64 time=1.24 ms
64 bytes from 192.168.100.100: icmp_seq=2 ttl=64 time=0.808 ms
64 bytes from 192.168.100.100: icmp_seq=3 ttl=64 time=0.712 ms
64 bytes from 192.168.100.100: icmp_seq=4 ttl=64 time=0.966 ms
^C
--- 192.168.100.100 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3008ms
rtt min/avg/max/mdev = 0.712/0.930/1.237/0.198 ms
bob@debClient:~$
```