Application Note 76

How to configure an Ubuntu OpenVPN server and a Digi TransPort WR as an OpenVPN client

September 2020

Contents

1 INTRODUCTION

1.1 Outline

This document describes how to configure an Ubuntu OpenVPN server and a TransPort WR router as an OpenVPN client.

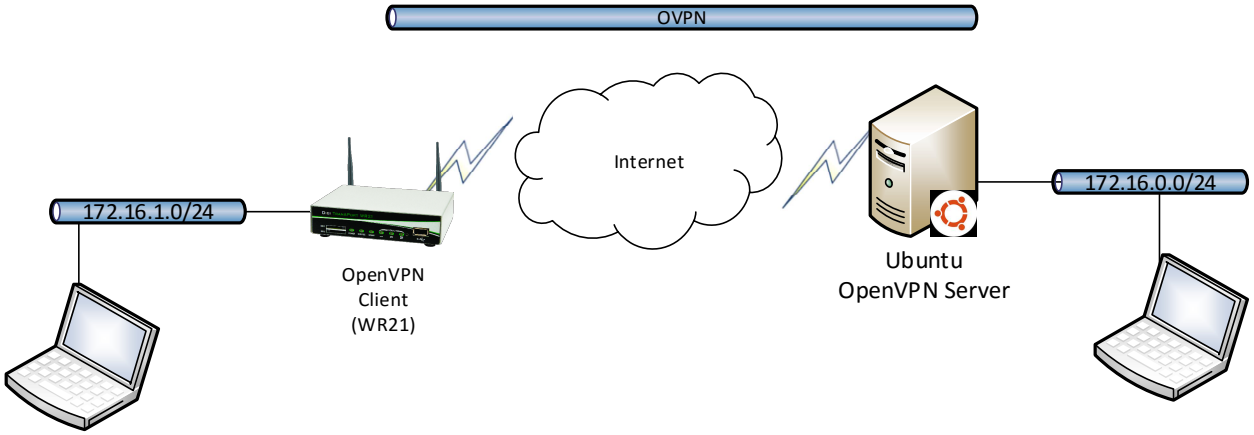
OpenVPN can be used for securely connecting the WR router to a central office network for access to services on the LAN side of the OpenVPN server, such as corporate messaging services, file servers and print servers for example.

From the OpenVPN website:

OpenVPN is a full-featured SSL VPN which implements OSI layer 2 or 3 secure network extension using the industry standard SSL/TLS protocol, supports flexible client authentication methods based on certificates, smart cards, and/or username/password credentials, and allows user or group-specific access control policies using firewall rules applied to the VPN virtual interface. OpenVPN is not a web application proxy and does not operate through a web browser.

OpenVPN 2.0 expands on the capabilities of OpenVPN 1.x by offering a scalable client/server mode, allowing multiple clients to connect to a single OpenVPN server process over a single TCP or UDP port.

For the purposes of this application note, the following scenario will be used:



OpenVPN is certificate based, so there will be certificates on the two peers.

A PC will be needed that can be used to install the OpenVPN Easy-RSA certificate authority and create & sign the certificates. The Ubuntu system machine will be used for this example purpose as well as OpenVPN server.

1.2 Assumptions

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product and of the requirements for their specific application. It also assumes a basic ability to access and navigate a Digi Transport router and configure it with basic routing functions.

This application note applies to:

Model: Digi Transport WR21

Other Compatible Models: All Digi WR TransPort models (SarOS)

Firmware versions: 5.077 and later

Configuration: This Application Note assumes the devices are set to their factory default configurations. Most configuration commands are only shown if they differ from the factory default.

Software used: OpenVPN 2.4.0 on Ubuntu 17.04

Acknowledgement: Much of the OpenVPN documentation has been taken directly from the HOWTO pages at the OpenVPN website. Please see http://openvpn.net/index.php/open-source/documentation/howto.html for more details

1.3 Corrections

Requests for corrections or amendments to this Application Note are welcome and should be addressed to: tech.support@digi.com

Requests for new Application Notes can be sent to the same address.

1.4 Version

Version Number	Status
1.0	Published (October 2017)
1.1	Added publish date, corrected links, minor fix (September 2020)

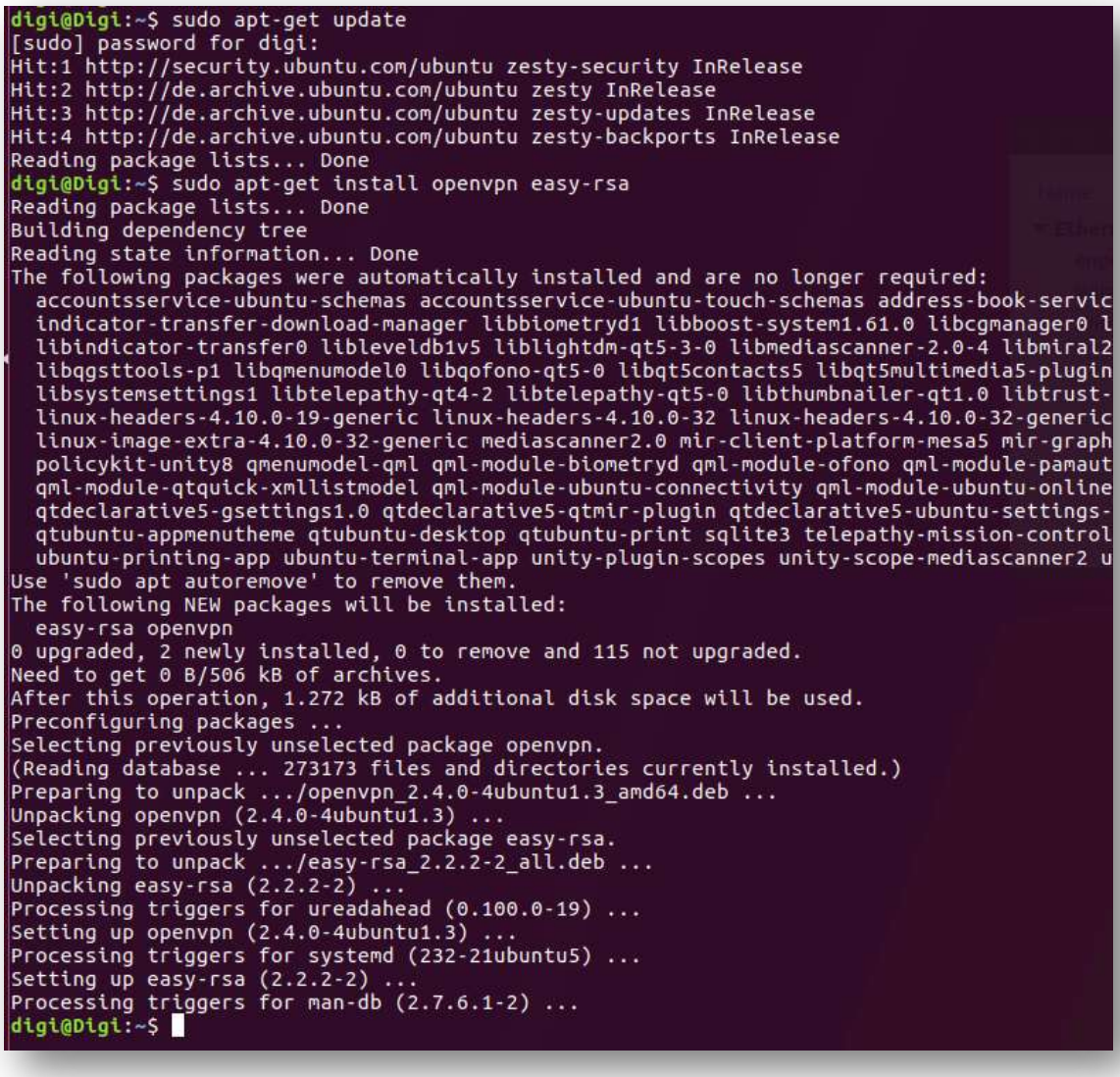
2 OPENVPN & EASY-RSA SETUP

2.1 Download the OpenVPN installation package and install the software

Open the terminal on the Ubuntu machine and download the latest OpenVPN with the following commands:

```
sudo apt-get update
sudo apt-get install openvpn easy-rsa
```

The output will be like the following:



2.2 Setting up Certificate Authority (CA) and generating certificates and keys

The first step in building an OpenVPN 2.x configuration is to establish a PKI (public key infrastructure). The PKI consists of:

- a separate certificate (also known as a public key) and private key for the server and each client
- a master Certificate Authority (CA) certificate and key which is used to sign each of the server and client certificates.

OpenVPN supports bidirectional authentication based on certificates, meaning that the client must authenticate the server certificate and the server must authenticate the client certificate before mutual trust is established.

Both server and client will authenticate the other by first verifying that the presented certificate was signed by the master certificate authority (CA), and then by testing information in the now-authenticated certificate header, such as the certificate common name or certificate type (client or server).

This security model has a number of desirable features from the VPN perspective:

- The server only needs its own certificate/key -- it doesn't need to know the individual certificates of every client which might possibly connect to it.
- The server will only accept clients whose certificates were signed by the master CA certificate (which we will generate below). And because the server can perform this signature verification without needing access to the CA private key itself, it is possible for the CA key (the most sensitive key in the entire PKI) to reside on a completely different machine, even one without a network connection.
- If a private key is compromised, it can be disabled by adding its certificate to a CRL (certificate revocation list). The CRL allows compromised certificates to be selectively rejected without requiring that the entire PKI be rebuilt.
- The server can enforce client-specific access rights based on embedded certificate fields, such as the Common Name.

Note that the server and client clocks need to be roughly in sync or certificates might not work properly.

2.2.1 Generate the master Certificate Authority (CA) certificate & key

Note: If certificates and key files have already been created, skip to section 3 (Page 15).

First of all, we need to create the CA directory and move into it:

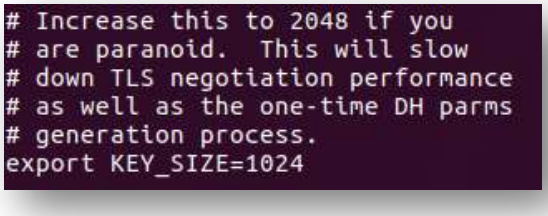
```
make-cadir ~/openvpn-ca2
cd ~/openvpn-ca
```

Then, the “vars” file must be edited, using a text editor like “nano”:

```
nano vars
```

The following values needs to be edited in the vars file, with the informations that will be placed in the certificates:

Please note that in the vars file there is also the possibility to change the Key size to use, in this example a key size of 1024 will be used:



Once the vars file is edited, save it (Ctrl + O) and exit from the editor (Ctrl + X).

Then, issue the source command for that file:

```
source vars
```

You should see the following if it was sourced correctly:

```
digi@Digi:~$ cd ~/openvpn-ca2
digi@Digi:~/openvpn-ca2$ source vars
NOTE: If you run ./clean-all, I will be doing a rm -rf on /home/digi/openvpn-ca2/keys
```

Make sure we're operating in a clean environment by typing:

```
./clean-all
```

Now, the root CA can be created with the following command:

```
./build-ca
```

The output will be like as following:

```
digi@Digi:~$ cd ~/openvpn-ca2
digi@Digi:~/openvpn-ca2$ source vars
NOTE: If you run ./clean-all, I will be doing a rm -rf on /home/digi/openvpn-ca2/keys
digi@Digi:~/openvpn-ca2$ ./clean-all
digi@Digi:~/openvpn-ca2$ ./build-ca
Generating a 1024 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) [DE]:
State or Province Name (full name) [BY]:
Locality Name (eg, city) [Munich]:
Organization Name (eg, company) [Digi]:
Organizational Unit Name (eg, section) [support]:
Common Name (eg, your name or your server's hostname) [Digi CA]:
Name [EasyRSA2]:
Email Address [support@digi.com]:
digi@Digi:~/openvpn-ca2$
```

Please note that most parameters can be defaulted.

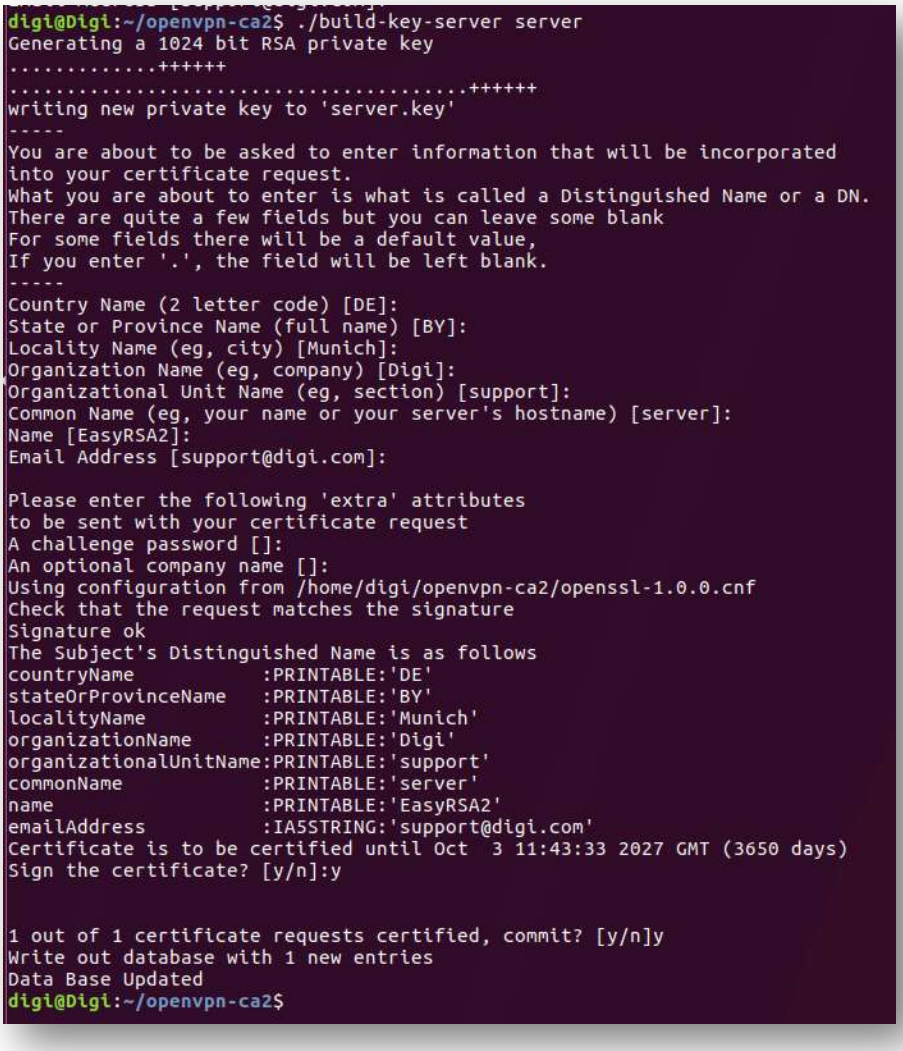
2.2.2 Generate certificate & key for server

Issue the following command on the Ubuntu terminal in order to build the certificates/key for the server side:

```
./build-key-server server
```

Please note that most parameters can be defaulted. Be sure that when the Common Name is queried, enter "server". Two other queries require positive responses, "Sign the certificate? [y/n]" and "1 out of 1 certificate requests certified, commit? [y/n]".

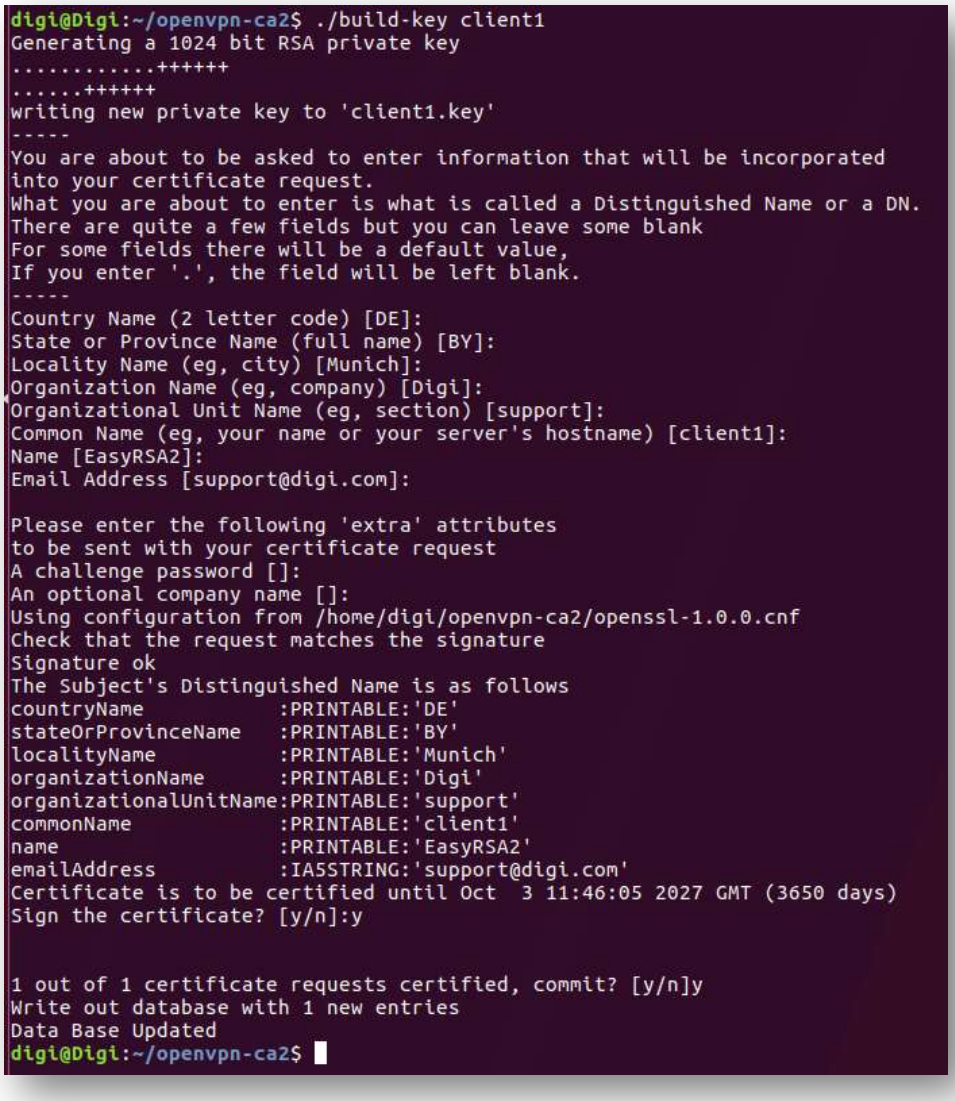
The output will be like the following:



2.2.3 Generate certificates & keys for the client

Generating client certificates is very similar to the previous step:

```
./build-key client1
```



2.2.4 Generate Diffie Hellman parameters

Diffie Hellman parameters must be generated for the OpenVPN server with the following command:

```
./build-dh
```

2.2.5 Generate TLS-AUTH key file

The tls-auth directive adds an additional HMAC signature to all SSL/TLS handshake packets for integrity verification. Any UDP packet not bearing the correct HMAC signature can be dropped without further processing. The tls-auth HMAC signature provides an additional level of security above and beyond that provided by SSL/TLS. It can protect against:

- DoS attacks or port flooding on the OpenVPN UDP port.
- Port scanning to determine which server UDP ports are in a listening state.
- Buffer overflow vulnerabilities in the SSL/TLS implementation.
- SSL/TLS handshake initiations from unauthorized machines (while such handshakes would ultimately fail to authenticate, tls-auth can cut them off at a much earlier point).

Using tls-auth requires that you generate a shared-secret key that is used in addition to the standard RSA certificate/key:

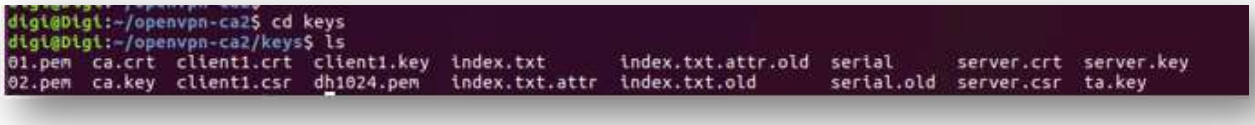
```
sudo openvpn --genkey --secret keys/ta.key
```

This command will generate an OpenVPN static key and write it to the file ta.key. This key should be copied over a pre-existing secure channel to the server and all client machines. It can be placed in the same directory as the RSA .key and .crt files.

2.2.6 Key Files

Now we will find our newly-generated keys and certificates in the keys subdirectory:

```
cd ~/openvpn-ca2/keys
```



Here is an explanation of the relevant files:

Filename	Needed By	Purpose	Secret
ca.crt	server + all clients	Root CA certificate	NO
ca.key	key signing machine only	Root CA key	YES
dh{n}.pem	server only	Diffie Hellman parameters	NO
server.crt	server only	Server Certificate	NO
server.key	server only	Server Key	YES
client1.crt	client1 only	Client1 Certificate	NO
client1.key	client1 only	Client1 Key	YES
ta.key	server+ all clients	Shared secret for TLS Authentication	YES

The final step in the key generation process is to copy all files to the machines which need them, taking care to copy secret files over a secure channel.

3 UBUNTU OPENVPN SERVER CONFIGURATION

The following steps explain the configuration that needs to be done on the Ubuntu OpenVPN server.

3.1 Install the OpenVPN software

This step is only required if the OpenVPN server is a different PC to the one used to create RSA certificates earlier. In this example the same Ubuntu system is used as per section above, so the software is already installed and ready to use.

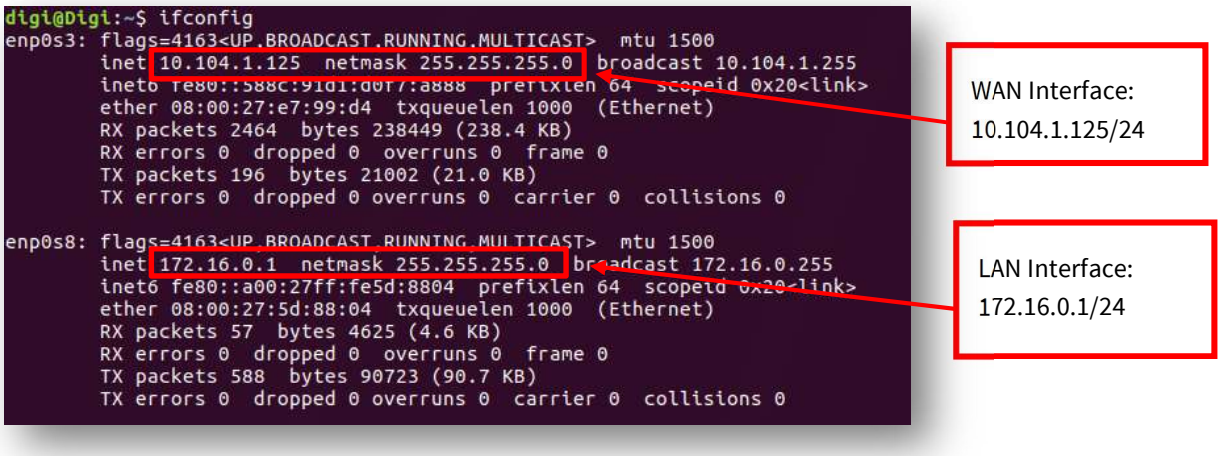
Please follow same steps as section 2.1 (Page 6) if a new installation is needed on the server.

3.2 Check Network Interfaces

Check Network Interfaces on the Ubuntu Server using the following command:

```
ifconfig
```

The IP addresses on the WAN interface (enp0s3) and LAN interface (enp0s8) will be used later for the configuration and test of the OpenVPN connection:



3.3 Install the SSL certificates

The SSL certificates that were created earlier should now be securely transferred from the Certificate Authority PC to the config folder of the Server machine (the Ubuntu system in this case).

The files that should be moved are:

ca.crt

dh1024.pem

server.crt

server.key

ta.key

In order to copy them to the correct OpenVPN folder, issue the following command:

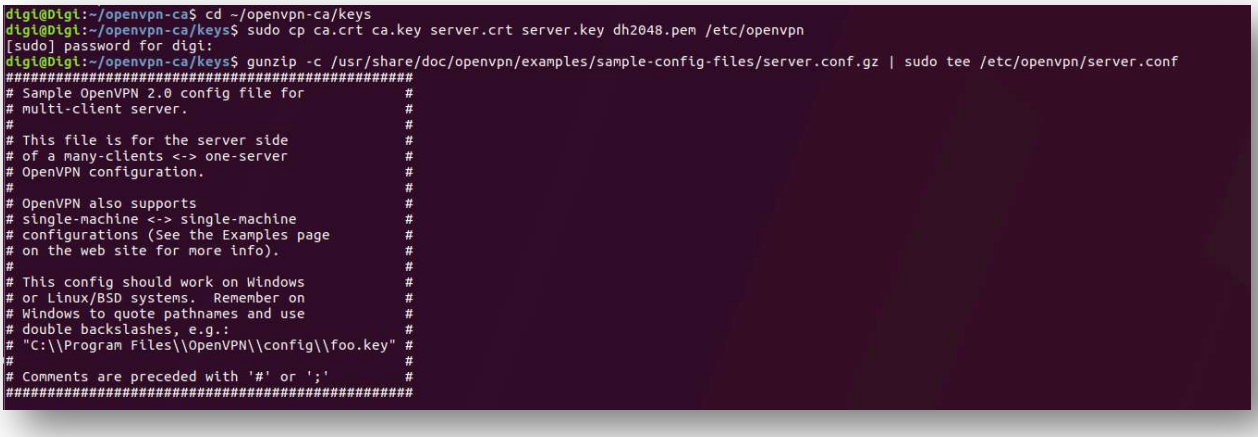
```
sudo cp ca.crt server.crt server.key dh1024.pem ta.key /etc/openvpn
```

3.4 Configure the OpenVPN Server (server.conf)

Next, we need to copy and unzip a sample OpenVPN configuration file into configuration directory so that can be used as a basis for the configuration:

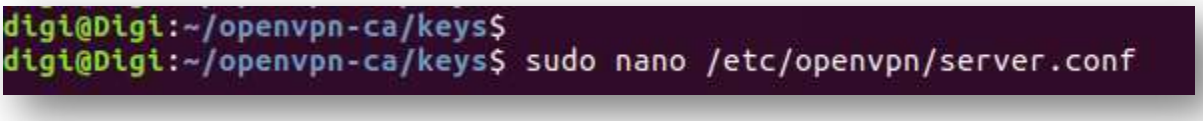
```
gunzip -c /usr/share/doc/openvpn/examples/sample-config-files/server.conf.gz | sudo
tee /etc/openvpn/server.conf
```

This command will show you the file content:



The configuration file must be edited, using a text editor like “nano”:

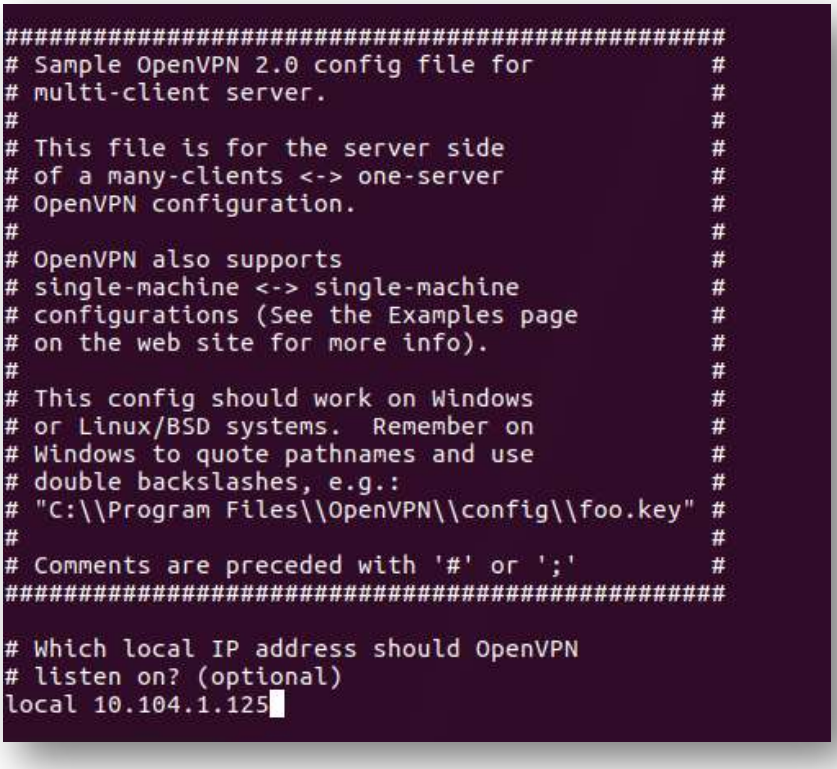
```
sudo nano /etc/openvpn/server.conf
```



The text file will be opened in the terminal window and the following sections should be edited/checked:

```
local 10.104.1.125
```

This is the local IP on which the OpenVPN server should listen on, so it is set in this case as the IP address that the server has on its WAN Interface.




```
server 10.8.0.0. 255.255.255.0
```

This is the subnet that will be associated to the OpenVPN connections. The server will take the first address (so 10.8.0.1) and the others will be available for the clients.

```
# Configure server mode and supply a VPN subnet
# for OpenVPN to draw client addresses from.
# The server will take 10.8.0.1 for itself,
# the rest will be made available to clients.
# Each client will be able to reach the server
# on 10.8.0.1. Comment this line out if you are
# ethernet bridging. See the man page for more info.
server 10.8.0.0 255.255.255.0
```

`push “route 172.16.0.0 255.255.255.0”`

This is the route to be pushed to the clients in order for them to reach the private LAN behind the server.

```
# Push routes to the client to allow it
# to reach other private subnets behind
# the server.  Remember that these
# private subnets will also need
# to know to route the OpenVPN client
# address pool (10.8.0.0/255.255.255.0)
# back to the OpenVPN server.
;push "route 192.168.10.0 255.255.255.0"
push "route 172.16.0.0 255.255.255.0"
```

`push “dhcp-option DNS 208.67.220.220”`

This is the command to push the DNS server address to clients. In this example the public OpenDNS address is set:

```
# Certain Windows-specific network settings
# can be pushed to clients, such as DNS
# or WINS server addresses.  CAVEAT:
# http://openvpn.net/faq.html#dhcpcaveats
# The addresses below refer to the public
# DNS servers provided by opendns.com.
;push "dhcp-option DNS 208.67.222.222"
push "dhcp-option DNS 208.67.220.220"
```

```
dh dh1024.pem
```

The DH parameters generated before must be set here.

```
# Diffie hellman parameters.
# Generate your own with:
#   openssl dhparam -out dh2048.pem 2048
dh dh1024.pem
```

```
tls-auth ta.key 0
```

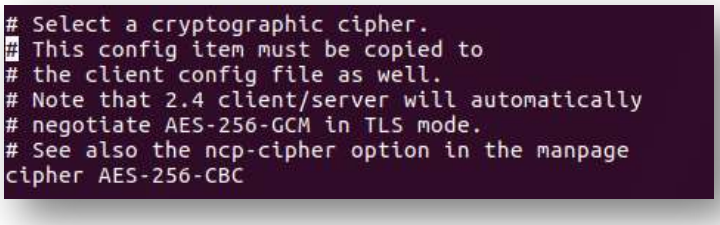
The TLS_AUTH key generated before must be set here.

NOTE: after the name of the key file, a direction parameter must be set. On server side this should be 0 as in this example. On the client side should be "1" in general, but please refer to section 4.5 for the correct setting on TransPort WR clients.

```
# For extra security beyond that provided
# by SSL/TLS, create an "HMAC firewall"
# to help block DoS attacks and UDP port flooding.
#
# Generate with:
#   openvpn --genkey --secret ta.key
#
# The server and each client must have
# a copy of this key.
# The second parameter should be '0'
# on the server and '1' on the clients.
tls-auth ta.key 0 # This file is secret
```

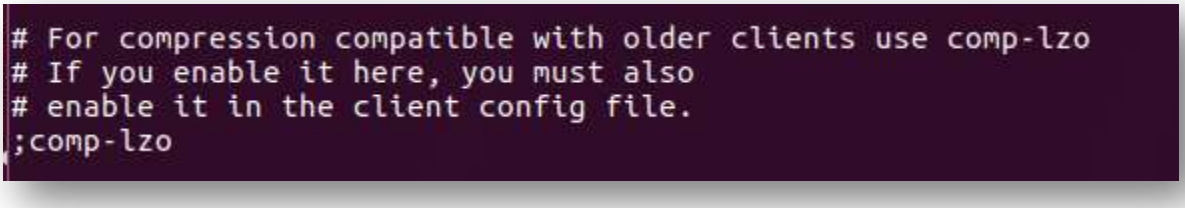
```
cipher AES-256-CBC
```

A cryptographic cipher needs to be chosen. For this application AES-256-CBC is set.




```
;comp-lzo
```

Be sure that the compression “comp.lzo” is disabled (so commented with the “;”), as this is not supported on TransPort WR routers.



When finished, save the file (Ctrl + O) and exit from the editor (Ctrl + X).

3.5 Start the OpenVPN Server

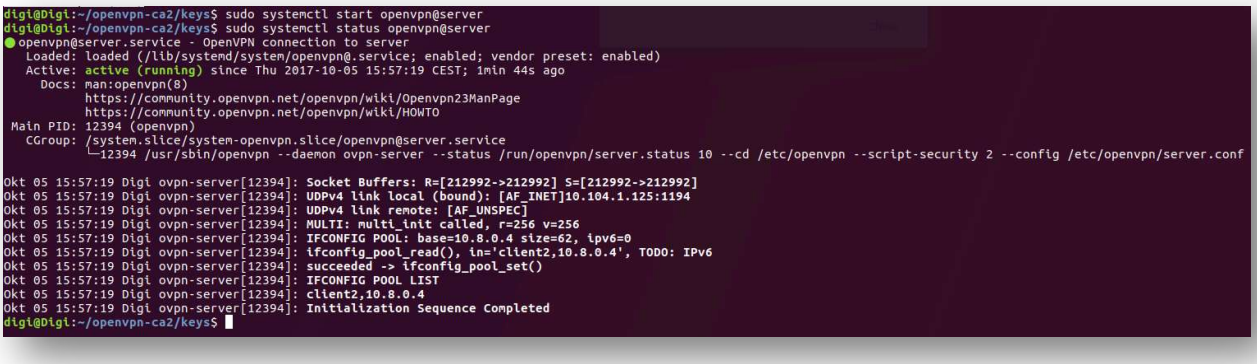
Use the following command to start the OpenVPN service:

```
sudo systemctl start openvpn@server
```

To double check that the OpenVPN server has started successfully and it is ready to accept client connections, issue the following:

```
sudo systemctl status openvpn@server
```

An output like the following should be displayed, showing that the status is “active (running)”:



You can also check that the OpenVPN tun0 interface is available by typing:

```
ip addr show tun0
```

This command should show as output a configured interface as following:

If everything is ok, the service can be also configured to start automatically at boot:

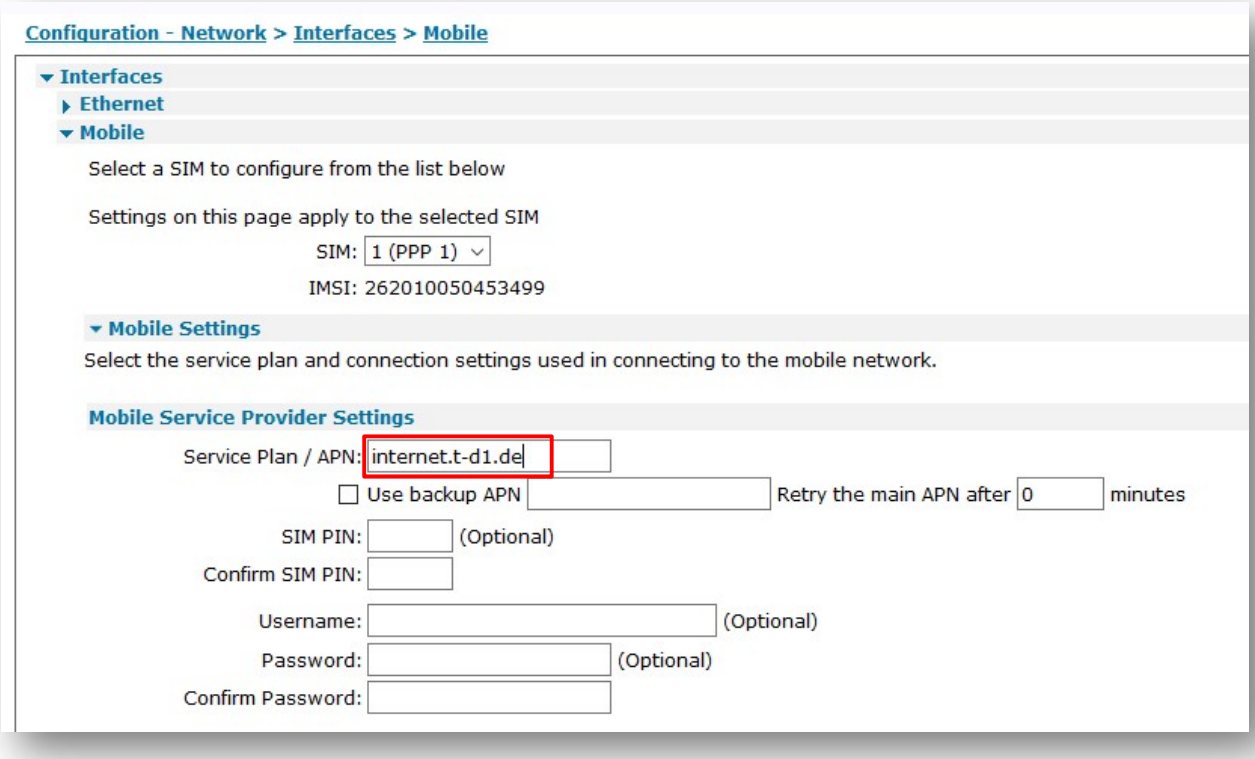
```
sudo systemctl enable openvpn@server
```

4 TRANSPORT WR CONFIGURATION

4.1 WAN Interface configuration

In this example the Client has the Mobile interface as the WAN interface and it is configured as follows:

CONFIGURATION - NETWORK > INTERFACES > MOBILE



Where:

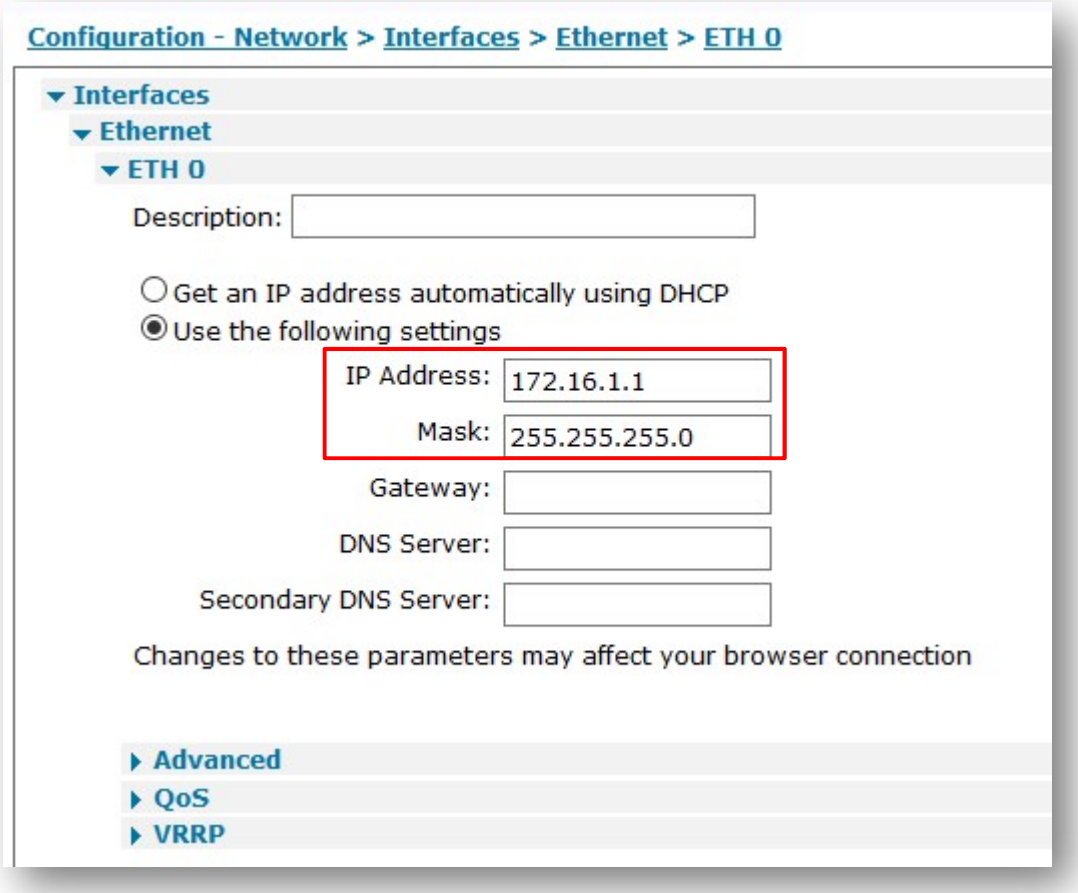
Parameter	Setting	Description
Service Plan/APN	Internet.t-d1.de	Enter the APN of your mobile provider

Please note: Depending on provider, a SIM PIN or Username/Password may be required. If needed, enter them in the appropriate fields.

4.2 LAN Interface configuration

In this example, the LAN interface is configured with a static address as follows:

CONFIGURATION - NETWORK > INTERFACES > ETHERNET > ETH 0



Where:

Parameter	Setting	Description
IP Address	172.16.1.1	Enter the IP address of the LAN interface for the router
Mask	255.255.255.0	Enter the subnet mask

4.3 Transfer Certificates and Key files

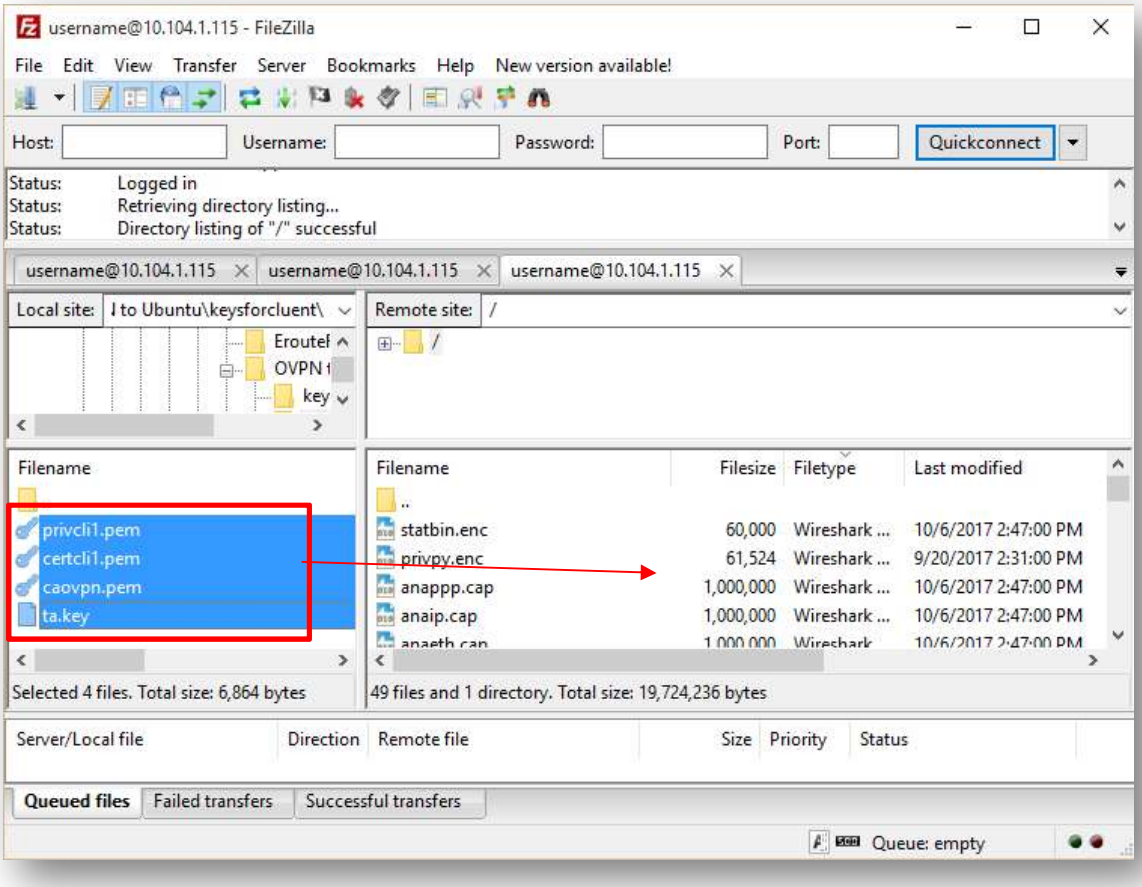
Before to transfer the Certificates and Key files on the client, they must be renamed as follows as .pem files:

Filename	Purpose	New FileName
ca.crt	Root CA certificate	**ca**ovpn.pem
client1.crt	Client1 Certificate	**cert**cli1.pem
client1.key	Client1 Key	**priv**cli1.pem
ta.key	Shared secret for TLS Authentication	ta.key

Note that the ta.key file for TLS authentication don't need to be renamed.

Once done that, the files can be transferred to the Client using for example an FTP client, connected with the TransPort router with usual username and password.

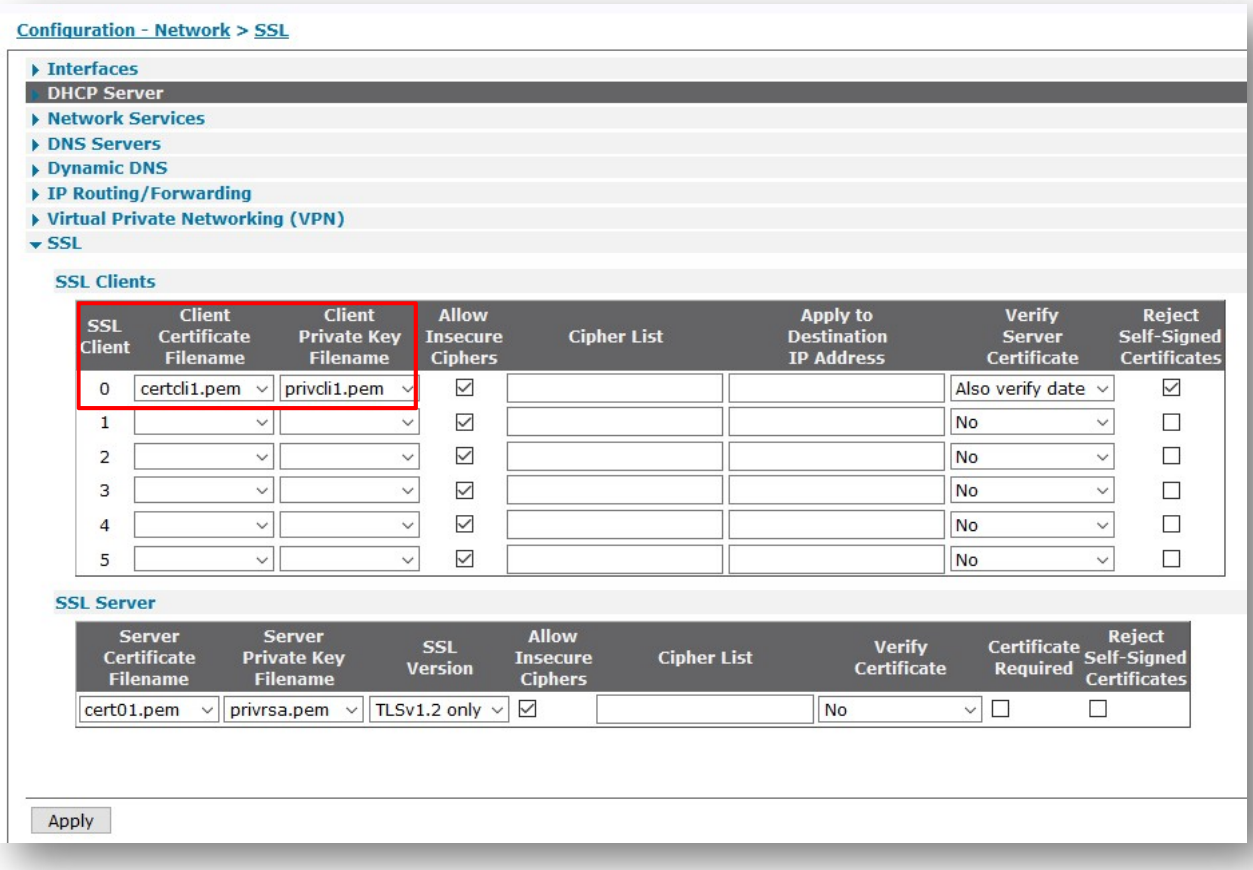
Please note that you may need to change your IP on the laptop accordingly with the new IP address configured on the ETH0 of the router.



4.4 SSL Certificates configuration

When the certificates have been transferred to the Client, the router needs to be configured so it knows which client certificate files to use:

CONFIGURATION – NETWORK > SSL



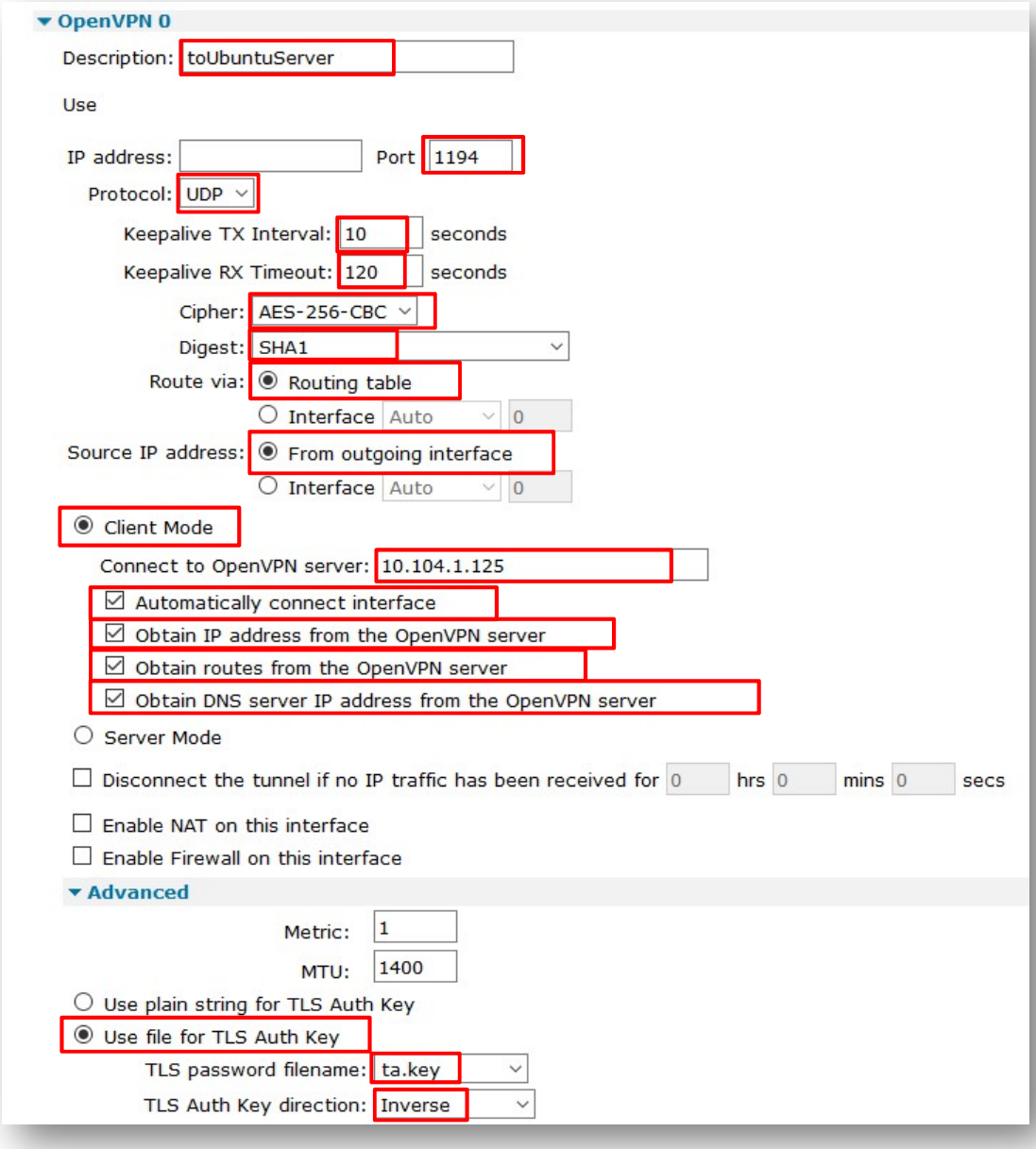
Where:

Parameter	Setting	Description
Client Certificate Filename	certcli1.pem	The name of the required certificate file is selected from those available on the router's filing system from this drop-down list. In this example this the one just transferred to the router.
Client Private Key Filename	privcli1.pem	The name of the file that contains the private key that matches the public key stored in the above parameter, is selected from this drop-down list. In this example this the one just transferred to the router.

4.5 OpenVPN Client mode configuration

An OpenVPN interface will be configured on the TransPort router that acts as OpenVPN client:

CONFIGURATION - NETWORK > VIRTUAL PRIVATE NETWORKING (VPN) > OPENVPN > OPENVPN 0



Where:

Parameter	Setting	Description
Description	toUbuntuServer	Friendly name for this interface
Port	1194 (default)	This is the TCP or UDP port number that the server will listen on for incoming VPN connections
Protocol	UDP (default)	This will either be TCP or UDP. It is up to the reader to decide which protocol to use, both the server and all clients must use the same protocol. See note with regards to protocol choice in the previous section
Keepalive TX Interval	10	Keepalive interval: Interval between OpenVPN ping transmissions. These are required to detect the operational state of the VPN connection.
Keepalive RX Timeout	120	Keepalive timeout before VPN is marked as down: If the server hasn't received a ping from the client in the time limit specified, the tunnel will be marked as down
Cipher	AES-256-CBC	Encryption algorithm to use. The cipher is not negotiated during tunnel establishment. The server and all clients must be configured to use the same cipher. If the ciphers do not match, decryption errors will occur.
Digest	SHA1 (default)	Authentication algorithm to use. The digest is not negotiated during tunnel establishment. The server and all clients must be configured to use the same digest. If the ciphers do not match, authentication errors will occur.
Route via	Routing table (default)	Uses the routing table to determine the best route
Source IP address	From outgoing interface (default)	The IP address of the outgoing interface will be used as the source IP address
Client Mode	Selected	Use Client mode
Connect to OpenVPN server	10.104.1.125	Public IP address of OpenVPN server
Automatically connect interface	✓	Connects to the OpenVPN server automatically, always on mode.
Obtain IP address from the OpenVPN server	✓	This interface will obtain an IP address from the OpenVPN server
Obtain routes from the OpenVPN server	✓	Routing information will be obtained from the OpenVPN server
Obtain DNS Server IP address from the OpenVPN server	✓	DNS Server information will be obtained from the OpenVPN server
Use file for TLS Auth Key	Selected	Enables the use of a key file for the TLS Authentication
TLS password filename	ta.key	Select the TLS password file just uploaded
TLS Auth Key direction	Inverse	Select the direction for the TLS Authentication Key. On the OpenVPN documentation is indicated to choose "1" on the client side. For TransPort WR router, there are 3 options Bidirectional, Normal and Inverse. On client side, "Inverse" should be used. So please note that this will be shown as "ovpn 0 tlskeydir **2**" in the configuration file for the WR, not "1". (1 will be Normal and 0 will be Bidirectional)

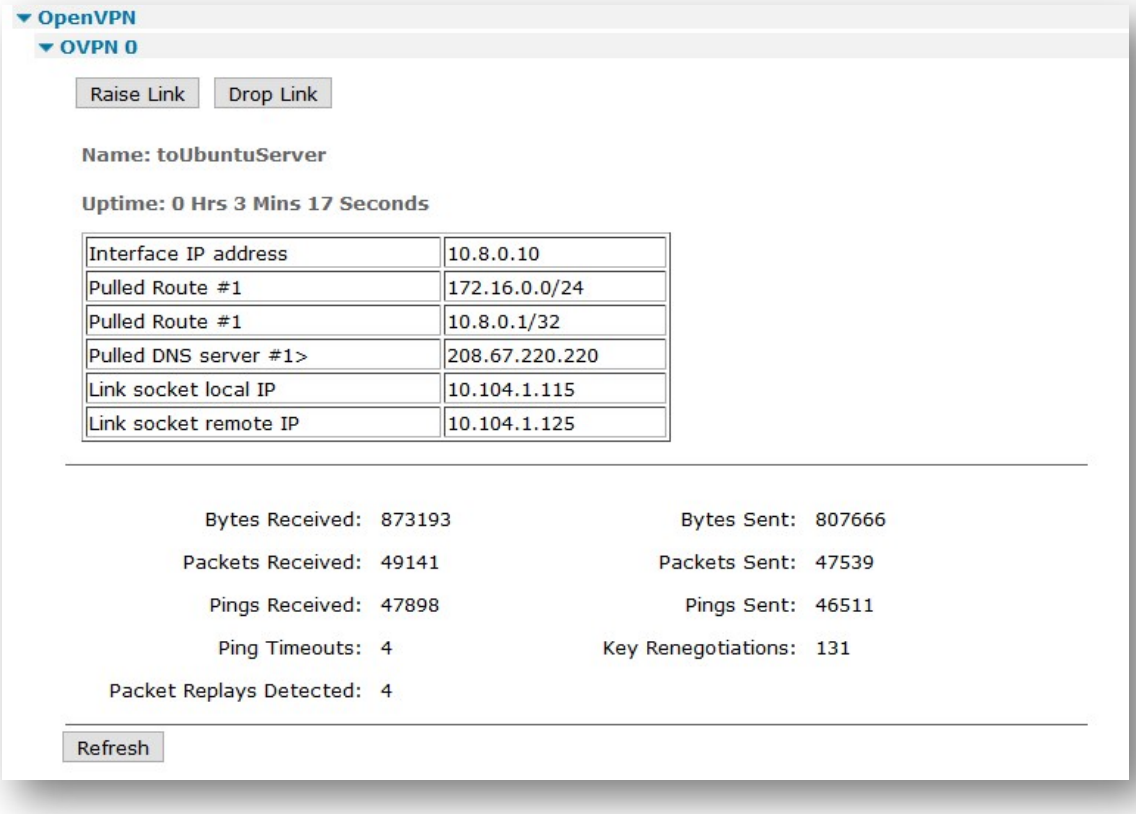
5 TEST OPENVPN CONNECTION

5.1 OpenVPN Connection Status

To check the OpenVPN connection status on the client, browse to:

MANAGEMENT - CONNECTIONS > VIRTUAL PRIVATE NETWORKING (VPN) > OPENVPN > OVPN 0

This will show if the connection is active and all the network settings pushed by the server, as well as traffic statistics details.



On Server side check the status of the OpenVPN Server and latest eventlogs will be displayed, showing the Client connection:

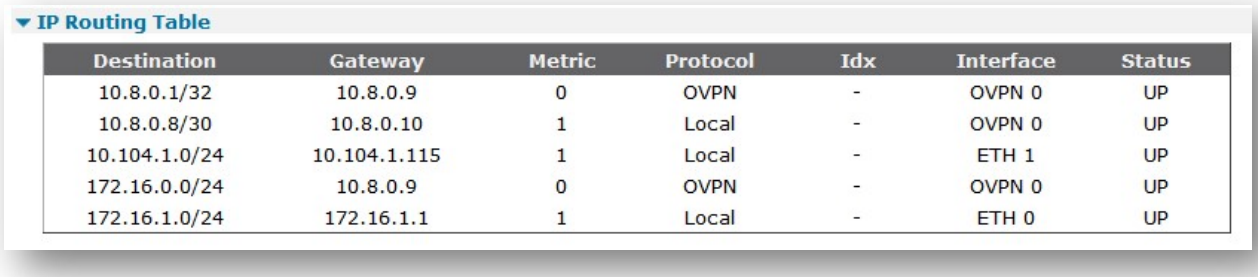
```
digi@Digi:~/openvpn-ca2/keys$ sudo systemctl status openvpn@server
● openvpn@server.service - OpenVPN connection to server
   Loaded: loaded (/lib/systemd/system/openvpn@.service; enabled; vendor preset:
enabled)
   Active: active (running) since Thu 2017-10-05 15:57:19 CEST; 23h ago
     Docs: man:openvpn(8)
           https://community.openvpn.net/openvpn/wiki/Openvpn23ManPage
           https://community.openvpn.net/openvpn/wiki/HOWTO
 Main PID: 12394 (openvpn)
   CGroup: /system.slice/system-openvpn.slice/openvpn@server.service
           └─12394 /usr/sbin/openvpn --daemon ovpn-server --status
/run/openvpn/server.status 10 --cd /etc/openvpn --script-security 2 --config
/etc/openvpn/server.conf --writepid /run/openvpn/server.pid

Okt 06 15:25:12 Digi ovpn-server[12394]: 10.104.1.115:13039 Data Channel Decrypt:
Cipher 'AES-256-CBC' initialized with 256 bit key
Okt 06 15:25:12 Digi ovpn-server[12394]: 10.104.1.115:13039 Data Channel Decrypt:
Using 160 bit message hash 'SHA1' for HMAC authentication
Okt 06 15:25:12 Digi ovpn-server[12394]: 10.104.1.115:13039 Control Channel: TLSv1.2,
cipher TLSv1/SSLv3 DHE-RSA-AES256-GCM-SHA384, 1024 bit RSA
Okt 06 15:25:12 Digi ovpn-server[12394]: 10.104.1.115:13039 [client1] Peer Connection
Initiated with [AF_INET]10.104.1.115:13039
Okt 06 15:25:12 Digi ovpn-server[12394]: MULTI: new connection by client 'client1'
will cause previous active sessions by this client to be dropped.  Remember to use
the --duplicate-cn option if you want
Okt 06 15:25:12 Digi ovpn-server[12394]: MULTI_sva: pool returned IPv4=10.8.0.10,
IPv6=(Not enabled)
Okt 06 15:25:12 Digi ovpn-server[12394]: MULTI: Learn: 10.8.0.10 ->
client1/10.104.1.115:13039
Okt 06 15:25:12 Digi ovpn-server[12394]: MULTI: primary virtual IP for
client1/10.104.1.115:13039: 10.8.0.10
Okt 06 15:25:12 Digi ovpn-server[12394]: client1/10.104.1.115:13039 PUSH: Received
control message: 'PUSH_REQUEST'
Okt 06 15:25:12 Digi ovpn-server[12394]: client1/10.104.1.115:13039 SENT CONTROL
[client1]: 'PUSH_REPLY,route 172.16.0.0 255.255.255.0,dhcp-option DNS
208.67.220.220,route 10.8.0.1,topology net30,ping 10,
lines 1-20/20 (END)
```

5.2 Routing Table

To better check that all routing information are correct in order to have the connection working as expected, check the routing table:

MANAGEMENT - NETWORK STATUS > IP ROUTING TABLE



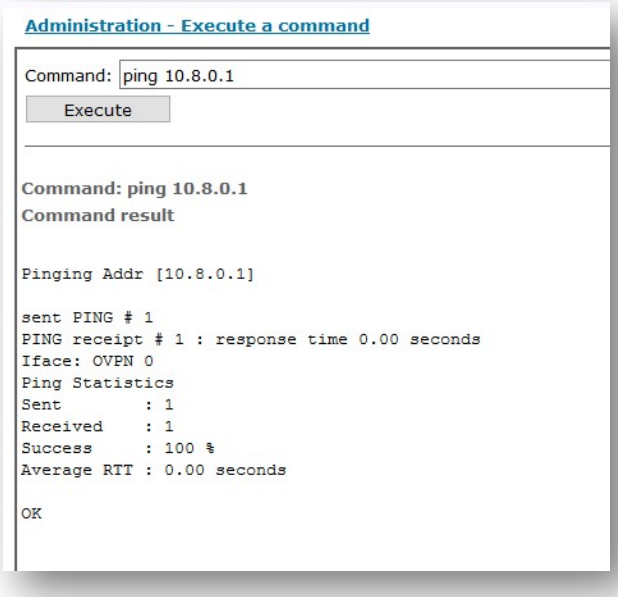
IP Routing Table

Destination	Gateway	Metric	Protocol	Idx	Interface	Status
10.8.0.1/32	10.8.0.9	0	OVPN	-	OVPN 0	UP
10.8.0.8/30	10.8.0.10	1	Local	-	OVPN 0	UP
10.104.1.0/24	10.104.1.115	1	Local	-	ETH 1	UP
172.16.0.0/24	10.8.0.9	0	OVPN	-	OVPN 0	UP
172.16.1.0/24	172.16.1.1	1	Local	-	ETH 0	UP

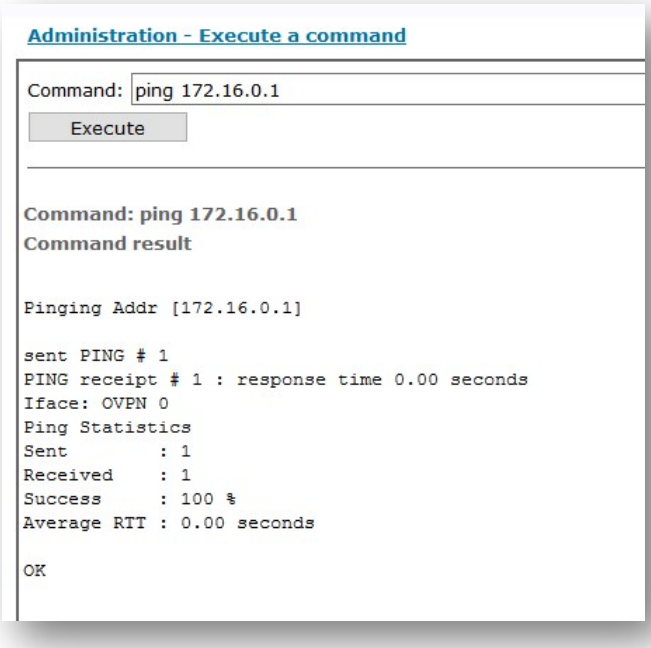
The network destination 172.16.0.0 with mask 255.255.255.0 is the route that has been pushed from the OpenVPN server.

5.3 Check the traffic on the OpenVPN Connection

Ping the OpenVPN Server address from the TransPort WR:



Ping the OpenVPN Server LAN address from the TransPort WR:



Both Ping will be successful and will be sent via the OpenVPN interface OVPN0.

6 FIRMWARE VERSIONS

6.1 Digi TransPort WR

```
Digi TransPort WR21-U22B-DE1-XX Ser#:237416
Software Build Ver5.2.19.6.  Aug 23 2017 11:05:52  WW
ARM Bios Ver 7.61u v43 454MHz B987-M995-F80-O8140,0 MAC:00042d039f68
Async Driver              Revision: 1.19  Int clk
Ethernet Port Isolate Driver Revision: 1.11
Firewall                  Revision: 1.0
EventEdit                 Revision: 1.0
Timer Module              Revision: 1.1
(B)USBHOST                Revision: 1.0
L2TP                      Revision: 1.10
PPTP                      Revision: 1.00
TACPLUS                   Revision: 1.00
MODBUS                    Revision: 0.00
RealPort                  Revision: 0.00
MultiTX                   Revision: 1.00
LAPB                      Revision: 1.12
X25 Layer                 Revision: 1.19
MACRO                     Revision: 1.0
PAD                       Revision: 1.4
X25 Switch                Revision: 1.7
V120                      Revision: 1.16
TPAD Interface            Revision: 1.12
GPS                       Revision: 1.0
TELITUPD                  Revision: 1.0
SCRIBATSK                 Revision: 1.0
BASTSK                    Revision: 1.0
PYTHON                    Revision: 1.0
CLOUDSMS                  Revision: 1.0
TCP (HASH mode)           Revision: 1.14
TCP Utils                 Revision: 1.13
PPP                       Revision: 5.2
WEB                       Revision: 1.5
SMTP                      Revision: 1.1
FTP Client                Revision: 1.5
FTP                       Revision: 1.5
IKE                       Revision: 1.0
PollANS                   Revision: 1.2
PPPOE                     Revision: 1.0
BRIDGE                    Revision: 1.1
MODEM CC (Huawei LTE)     Revision: 5.2
FLASH Write               Revision: 1.2
Command Interpreter       Revision: 1.38
SSLCLI                    Revision: 1.0
OSPF                      Revision: 1.0
BGP                       Revision: 1.0
QOS                       Revision: 1.0
PWRCTRL                   Revision: 1.0
RADIUS Client             Revision: 1.0
```

```
SSH Server                Revision: 1.0
SCP                       Revision: 1.0
SSH Client                Revision: 1.0
CERT                      Revision: 1.0
LowPrio                   Revision: 1.0
Tunnel                    Revision: 1.2
OVPN                      Revision: 1.2
TEMPLOG                   Revision: 1.0
QDL                       Revision: 1.0
OK
```

6.2 Ubuntu OpenVPN Server

```
digi@Digi:~/openvpn-ca2/keys$ openvpn --version
OpenVPN 2.4.0 x86_64-pc-linux-gnu [SSL (OpenSSL)] [LZO] [LZ4] [EPOLL] [PKCS11]
[MH/PKTINFO] [AEAD] built on Jun 22 2017
library versions: OpenSSL 1.0.2g  1 Mar 2016, LZO 2.08
Originally developed by James Yonan
Copyright (C) 2002-2017 OpenVPN Technologies, Inc. <sales@openvpn.net>
Compile time defines: enable_async_push=no enable_comp_stub=no enable_crypto=yes
enable_crypto_ofb_cfb=yes enable_debug=yes enable_def_auth=yes
enable_dependency_tracking=no enable_dlopen=unknown enable_dlopen_self=unknown
enable_dlopen_self_static=unknown enable_fast_install=needless enable_fragment=yes
enable_iproute2=yes enable_libtool_lock=yes enable_lz4=yes enable_lzo=yes
enable_maintainer_mode=no enable_management=yes enable_multi=yes enable_multihome=yes
enable_pam_dlopen=no enable_password_save=yes enable_pedantic=no enable_pf=yes
enable_pkcs11=yes enable_plugin_auth_pam=yes enable_plugin_down_root=yes
enable_plugins=yes enable_port_share=yes enable_selinux=no enable_server=yes
enable_shared=yes enable_shared_with_static_runtimes=no enable_silent_rules=no
enable_small=no enable_static=yes enable_strict=no enable_strict_options=no
enable_systemd=yes enable_werror=no enable_win32_dll=yes enable_x509_alt_username=yes
with_crypto_library=openssl with_gnu_ld=yes with_mem_check=no
with_plugindir='${prefix}/lib/openvpn' with_sysroot=no
```

7 CONFIGURATION FILES

7.1 Digi Transport WR

```
eth 0 IPaddr "172.16.1.1"
eth 0 ipanon ON
lapb 0 ans OFF
lapb 0 tinact 120
lapb 1 tinact 120
lapb 3 dtemode 0
lapb 4 dtemode 0
lapb 5 dtemode 0
lapb 6 dtemode 0
ip 0 cidr ON
def_route 0 ll_ent "ppp"
def_route 0 ll_add 1
dhcp 0 IPmin "192.168.1.100"
dhcp 0 respdelms 500
dhcp 0 mask "255.255.255.0"
dhcp 0 gateway "192.168.1.1"
dhcp 0 DNS "192.168.1.1"
sntp 0 server "time.devicecloud.com"
dyndns 0 ifent "default"
ppp 0 timeout 300
ppp 1 name "W-WAN (LTE)"
ppp 1 phonenum "*98*1#"
ppp 1 IPaddr "0.0.0.0"
ppp 1 timeout 0
ppp 1 use_modem 1
ppp 1 aodion 1
ppp 1 autoassert 1
ppp 1 r_chap OFF
ppp 3 defpak 16
ppp 4 defpak 16
web 0 prelogin_info ON
web 0 showgswiz ON
modemcc 0 info_asy_add 4
modemcc 0 init_str "+CGQREQ=1"
modemcc 0 init_str1 "+CGQMIN=1"
modemcc 0 apn "internet.t-d1.de"
modemcc 0 link_retries 10
modemcc 0 stat_retries 30
modemcc 0 sms_interval 1
modemcc 0 sms_access 1
modemcc 0 sms_concat 0
modemcc 0 init_str_2 "+CGQREQ=1"
modemcc 0 init_str1_2 "+CGQMIN=1"
modemcc 0 apn_2 "Your.APN.goes.here"
modemcc 0 link_retries_2 10
modemcc 0 stat_retries_2 30
modemcc 0 sms_access_2 1
modemcc 0 sms_concat_2 0
```

```
ana 0 anon ON
ana 0 l2on OFF
ana 0 xoton OFF
ana 0 lapdon 0
ana 0 lapbon 0
ana 0 maxdata 1500
ana 0 logsize 180
cmd 0 unitid "ss%s>"
cmd 0 cmdnua "99"
cmd 0 hostname "digi.router"
cmd 0 asyled_mode 2
cmd 0 tremto 1200
cmd 0 rcihttp ON
user 0 access 0
user 1 name "username"
user 1 epassword "KD5lSVJDVVg="
user 1 access 0
user 2 access 0
user 3 access 0
user 4 access 0
user 5 access 0
user 6 access 0
user 7 access 0
user 8 access 0
user 9 access 0
local 0 transaccess 2
sslcli 0 certfile "certcli1.pem"
sslcli 0 keyfile "privcli1.pem"
sslcli 0 verify 10
sslsvr 0 certfile "cert01.pem"
sslsvr 0 keyfile "privrsa.pem"
ssh 0 hostkey1 "privSSH.pem"
ssh 0 nb_listen 5
ssh 0 v1 OFF
ovpn 0 descr "toUbuntuServer"
ovpn 0 dest "10.104.1.125"
ovpn 0 autoup ON
ovpn 0 ipanon ON
ovpn 0 pullip ON
ovpn 0 pullroute ON
ovpn 0 pulldns ON
ovpn 0 pingint 10
ovpn 0 pingto 120
ovpn 0 cipher "AES-256-CBC"
ovpn 0 tlskeyfile "ta.key"
ovpn 0 tlskeydir 2
templog 0 mo_autooff ON
cloud 0 ssl ON
```

7.2 Ubuntu OpenVPN Server

```
#############################################
# Sample OpenVPN 2.0 config file for        #
# multi-client server.                      #
#                                           #
# This file is for the server side          #
# of a many-clients <-> one-server          #
# OpenVPN configuration.                    #
#                                           #
# OpenVPN also supports                     #
# single-machine <-> single-machine         #
# configurations (See the Examples page     #
# on the web site for more info).           #
#                                           #
# This config should work on Windows        #
# or Linux/BSD systems.  Remember on        #
# Windows to quote pathnames and use        #
# double backslashes, e.g.:                 #
# "C:\\Program Files\\OpenVPN\\config\\foo.key" #
#                                           #
# Comments are preceded with '#' or ';'     #
#############################################

# Which local IP address should OpenVPN
# listen on? (optional)
local 10.104.1.125

# Which TCP/UDP port should OpenVPN listen on?
# If you want to run multiple OpenVPN instances
# on the same machine, use a different port
# number for each one.  You will need to
# open up this port on your firewall.
port 1194

# TCP or UDP server?
;proto tcp
proto udp

# "dev tun" will create a routed IP tunnel,
# "dev tap" will create an ethernet tunnel.
# Use "dev tap0" if you are ethernet bridging
# and have precreated a tap0 virtual interface
# and bridged it with your ethernet interface.
# If you want to control access policies
# over the VPN, you must create firewall
# rules for the the TUN/TAP interface.
# On non-Windows systems, you can give
# an explicit unit number, such as tun0.
# On Windows, use "dev-node" for this.
# On most systems, the VPN will not function
# unless you partially or fully disable
# the firewall for the TUN/TAP interface.
;dev tap
```

```
dev tun

# Windows needs the TAP-Win32 adapter name
# from the Network Connections panel if you
# have more than one.  On XP SP2 or higher,
# you may need to selectively disable the
# Windows firewall for the TAP adapter.
# Non-Windows systems usually don't need this.
;dev-node MyTap

# SSL/TLS root certificate (ca), certificate
# (cert), and private key (key).  Each client
# and the server must have their own cert and
# key file.  The server and all clients will
# use the same ca file.
#
# See the "easy-rsa" directory for a series
# of scripts for generating RSA certificates
# and private keys.  Remember to use
# a unique Common Name for the server
# and each of the client certificates.
#
# Any X509 key management system can be used.
# OpenVPN can also use a PKCS #12 formatted key file
# (see "pkcs12" directive in man page).
ca ca.crt
cert server.crt
key server.key  # This file should be kept secret

# Diffie hellman parameters.
# Generate your own with:
#   openssl dhparam -out dh2048.pem 2048
dh dh1024.pem

# Network topology
# Should be subnet (addressing via IP)
# unless Windows clients v2.0.9 and lower have to
# be supported (then net30, i.e. a /30 per client)
# Defaults to net30 (not recommended)
;topology subnet

# Configure server mode and supply a VPN subnet
# for OpenVPN to draw client addresses from.
# The server will take 10.8.0.1 for itself,
# the rest will be made available to clients.
# Each client will be able to reach the server
# on 10.8.0.1. Comment this line out if you are
# ethernet bridging. See the man page for more info.
server 10.8.0.0 255.255.255.0

# Maintain a record of client <-> virtual IP address
# associations in this file.  If OpenVPN goes down or
# is restarted, reconnecting clients can be assigned
# the same virtual IP address from the pool that was
```

```
# previously assigned.
ifconfig-pool-persist ipp.txt

# Configure server mode for ethernet bridging.
# You must first use your OS's bridging capability
# to bridge the TAP interface with the ethernet
# NIC interface.  Then you must manually set the
# IP/netmask on the bridge interface, here we
# assume 10.8.0.4/255.255.255.0.  Finally we
# must set aside an IP range in this subnet
# (start=10.8.0.50 end=10.8.0.100) to allocate
# to connecting clients.  Leave this line commented
# out unless you are ethernet bridging.
;server-bridge 10.8.0.4 255.255.255.0 10.8.0.50 10.8.0.100

# Configure server mode for ethernet bridging
# using a DHCP-proxy, where clients talk
# to the OpenVPN server-side DHCP server
# to receive their IP address allocation
# and DNS server addresses.  You must first use
# your OS's bridging capability to bridge the TAP
# interface with the ethernet NIC interface.
# Note: this mode only works on clients (such as
# Windows), where the client-side TAP adapter is
# bound to a DHCP client.
;server-bridge

# Push routes to the client to allow it
# to reach other private subnets behind
# the server.  Remember that these
# private subnets will also need
# to know to route the OpenVPN client
# address pool (10.8.0.0/255.255.255.0)
# back to the OpenVPN server.
;push "route 192.168.10.0 255.255.255.0"
push "route 172.16.0.0 255.255.255.0"

# To assign specific IP addresses to specific
# clients or if a connecting client has a private
# subnet behind it that should also have VPN access,
# use the subdirectory "ccd" for client-specific
# configuration files (see man page for more info).

# EXAMPLE: Suppose the client
# having the certificate common name "Thelonious"
# also has a small subnet behind his connecting
# machine, such as 192.168.40.128/255.255.255.248.
# First, uncomment out these lines:
;client-config-dir ccd
;route 192.168.40.128 255.255.255.248
# Then create a file ccd/Thelonious with this line:
#   iroute 192.168.40.128 255.255.255.248
# This will allow Thelonious' private subnet to
# access the VPN.  This example will only work
```

```
# if you are routing, not bridging, i.e. you are
# using "dev tun" and "server" directives.

# EXAMPLE: Suppose you want to give
# Thelonious a fixed VPN IP address of 10.9.0.1.
# First uncomment out these lines:
;client-config-dir ccd
;route 10.9.0.0 255.255.255.252
# Then add this line to ccd/Thelonious:
#   ifconfig-push 10.9.0.1 10.9.0.2

# Suppose that you want to enable different
# firewall access policies for different groups
# of clients.  There are two methods:
# (1) Run multiple OpenVPN daemons, one for each
#     group, and firewall the TUN/TAP interface
#     for each group/daemon appropriately.
# (2) (Advanced) Create a script to dynamically
#     modify the firewall in response to access
#     from different clients.  See man
#     page for more info on learn-address script.
;learn-address ./script

# If enabled, this directive will configure
# all clients to redirect their default
# network gateway through the VPN, causing
# all IP traffic such as web browsing and
# and DNS lookups to go through the VPN
# (The OpenVPN server machine may need to NAT
# or bridge the TUN/TAP interface to the internet
# in order for this to work properly).
;push "redirect-gateway def1 bypass-dhcp"

# Certain Windows-specific network settings
# can be pushed to clients, such as DNS
# or WINS server addresses.  CAVEAT:
# http://openvpn.net/faq.html#dhcpcaveats
# The addresses below refer to the public
# DNS servers provided by opendns.com.
;push "dhcp-option DNS 208.67.222.222"
push "dhcp-option DNS 208.67.220.220"

# Uncomment this directive to allow different
# clients to be able to "see" each other.
# By default, clients will only see the server.
# To force clients to only see the server, you
# will also need to appropriately firewall the
# server's TUN/TAP interface.
;client-to-client

# Uncomment this directive if multiple clients
# might connect with the same certificate/key
# files or common names.  This is recommended
# only for testing purposes.  For production use,
```

```
# each client should have its own certificate/key
# pair.
#
# IF YOU HAVE NOT GENERATED INDIVIDUAL
# CERTIFICATE/KEY PAIRS FOR EACH CLIENT,
# EACH HAVING ITS OWN UNIQUE "COMMON NAME",
# UNCOMMENT THIS LINE OUT.
;duplicate-cn

# The keepalive directive causes ping-like
# messages to be sent back and forth over
# the link so that each side knows when
# the other side has gone down.
# Ping every 10 seconds, assume that remote
# peer is down if no ping received during
# a 120 second time period.
keepalive 10 120

# For extra security beyond that provided
# by SSL/TLS, create an "HMAC firewall"
# to help block DoS attacks and UDP port flooding.
#
# Generate with:
#   openvpn --genkey --secret ta.key
#
# The server and each client must have
# a copy of this key.
# The second parameter should be '0'
# on the server and '1' on the clients.
tls-auth ta.key 0 # This file is secret

# Select a cryptographic cipher.
# This config item must be copied to
# the client config file as well.
# Note that 2.4 client/server will automatically
# negotiate AES-256-GCM in TLS mode.
# See also the ncp-cipher option in the manpage
cipher AES-256-CBC

# Enable compression on the VPN link and push the
# option to the client (2.4+ only, for earlier
# versions see below)
;compress lz4-v2
;push "compress lz4-v2"

# For compression compatible with older clients use comp-lzo
# If you enable it here, you must also
# enable it in the client config file.
;comp-lzo

# The maximum number of concurrently connected
# clients we want to allow.
;max-clients 100
```

```
# It's a good idea to reduce the OpenVPN
# daemon's privileges after initialization.
#
# You can uncomment this out on
# non-Windows systems.
;user nobody
;group nogroup

# The persist options will try to avoid
# accessing certain resources on restart
# that may no longer be accessible because
# of the privilege downgrade.
persist-key
persist-tun

# Output a short status file showing
# current connections, truncated
# and rewritten every minute.
status openvpn-status.log

# By default, log messages will go to the syslog (or
# on Windows, if running as a service, they will go to
# the "\Program Files\OpenVPN\log" directory).
# Use log or log-append to override this default.
# "log" will truncate the log file on OpenVPN startup,
# while "log-append" will append to it.  Use one
# or the other (but not both).
;log         openvpn.log
;log-append  openvpn.log

# Set the appropriate level of log
# file verbosity.
#
# 0 is silent, except for fatal errors
# 4 is reasonable for general usage
# 5 and 6 can help to debug connection problems
# 9 is extremely verbose
verb 3

# Silence repeating messages.  At most 20
# sequential messages of the same message
# category will be output to the log.
;mute 20

# Notify the client that when the server restarts so it
# can automatically reconnect.
explicit-exit-notify 1
```